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ABSTRACT

This report is one of a series of papers analyzing how employers select and train employees and the implications of their behavior for schools. Data for the study were gathered in telephone interviews with more than 3,500 employees conducted by the Gallup Organization. This report is organized in three chapters. In the first chapter, John Barron and John Bishop examine extensive search and intensive search, and determine which of these methods are used by different types of employers and why. Costs of each method are also discussed. Chapter 2, by John Bishop, explores why employers prefer informal recruitment mechanisms and the implications of this preference. The final chapter, by John Bishop and Suk Kang, asks the question: Why do employers underinvest in on-the-job training? and analyzes the results of this employer policy. This chapter also looks at the relationship between employer decisions about on-the-job training and the effects of these decisions on society as a whole. An extensive executive summary and data tables are included in this report. Appendixes include statistical computations, the employer questionnaire, and references. (KC)

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HIRING AND TRAINING WORKERS

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HIRING AND TRAINING WORKERS

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FOREWORD

Very little is known about the character of employer selection and training policies and how they interface with schools. To address these and other issues, the National Center for Research in Vocational Education commissioned the Gallup Organization to conduct telephone interviews with over 3,500 employers. This report is one of a series of papers analyzing how employers select and train employees and the implications of their behavior for schools.

We wish to express our gratitude to the National Institute of Education for funding the data collection effort that provided the database for this study and its' support of the analysis presented in this report. We wish to also thank Ron Bucknam who served as institutional monitor for his guidance and support. We wish to acknowledge the support from the National Commission for Employment Policy, Department of Labor, and the Swedish Institute for Social Research for earlier stages of this research.

This research would not have been possible without the cooperation and assistance of 3,500 employers who so graciously responded to our telephone interview. We greatly appreciate the time and the insights that these very busy men and women contributed to the study.

The project is also indebted to the many employers who assisted in the design of the interview instrument. In this regard, special thanks are due to Jim Medoff, Harvard University; Frank Stafford, Chairman of the Department of Economics, University of Michigan; Clifford Roe, Supervisor of Salaried Union Relations and EEO Administrator (retired), Buffalo Divisions, Westinghouse Electric Corporation; and William J. Dennis, Research Director, National Federation of Independent Business. Wilson S. Johnson, President of the National Federation of Independent Business, was very supportive of the study and graciously provided a letter of introduction that we sent to all the employers selected for an interview.

Thanks are extended to the staff at the Gallup Organization who supervised the telephone survey: Mitchell Cohen, Nancy Nygreen, Peggy Ashton, and Corinne Kyle. Reviewers of an earlier draft of this report: John McCall, Masanori Hashimoto, Lawrence Kahn, Dale Mortensen, John Gardner, and Kevin Hollenbeck made many helpful suggestions. Terrence Davey did the programming and database preparation; the manuscript was edited by Judy Balogh and Janet Kiplinger of the National Center's editorial staff; and it was typed by Cathy Cathy Jones, Colleen Kinzelman, and Vera Mueller. A nontechnical summary version of this paper with the same title is available.

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

1.0 EXTENSIVE SEARCH, INTENSIVE SEARCH, AND HIRING COSTS

The recruitment, screening, and evaluation process that precedes a hiring selection is an information gathering process. Since the collection and processing of information is costly, the amount and character of the firm's investment in information depends upon a calculation of costs and benefits. The benefit being sought is the selection of the best possible worker. To the employer, the true present value of labor services offered by a new employee is a random variable whose distribution can be changed by the acquisition of information.

Since the information set used to make the hiring selections is subject to the firm's control, there are really two margins or dimensions of search investment. First, there is an extensive margin. A good proxy for the extent of search is the number of applicants evaluated per job offer. The extent of a firm's search is determined by policies like the following: whether ads are placed in the paper; whether and from where referrals are requested; how long the search process is allowed to continue; and whether job applications are accepted when there are no immediate vacancies, and then reviewed when an opening occurs. Manufacturing employers typically engage in the most extensive search. Mining and construction companies engage in the least extensive search. The extent of search seems to be greatest for clerical jobs and least for professional, technical, managerial, and blue-collar jobs.

There is also an intensive margin--the amount of information obtained on each candidate and the care with which that information is used to make selections. The firm's search intensity is determined by a variety of policies and practices that regulate the selection process: the information requested on the job application, whether references are called; whether school transcripts or examples of previous work are requested; the number and length of interviews, and the existence and nature of medical, psychological, or skill examinations. A reasonably good proxy for the intensity of search is given by the total number of hours spent by company personnel in recruiting, screening, and interviewing divided by the number of applicants for the position. There are important differences across occupations in the intensity and total costs of search. Employer search is much more intense and costly for professional, technical, and managerial jobs, and least intense and costly for service and blue-collar jobs.

An employer survey sponsored by the National Institute of Education and the National Center for Research in Vocational Education that was conducted between February and June 1982 provides the basis for analyzing employer search and hiring costs. Each employer surveyed was asked about the screening and interviewing activity associated with the last employee hired prior to August 1981.

Models explaining the ratio of applicants to interviews, the ratio of interviews to offers, the ratio of hours invested to applicants, and total direct costs (hours spent per offer) were estimated. Explanatory variables included employment size of the establishment and firm, measures of the flow of phone and in-person contacts, temporary or seasonal nature of the job, amount and type of training required for the job, physical capital required to perform the job, unionization, measures of indirect hiring costs, degree of difficulty of dismissal, and occupation.

Large employers were expected to engage in more extensive and intensive search for two reasons: (1) their marginal cost of search is lower because the screening and interviewing function is specialized; and (2) the dispersion of possible outcomes and, therefore, the payoff to search is greater because monitoring and dismissal costs are higher in large establishments and in multiestablishment firms. The evidence indicates that large firms do engage in more extensive search: establishments with 10 times as many employees review 19 percent more applicants per interview and conduct 17 percent more interviews to fill a position. Multiestablishment firms conduct 28 percent more interviews to make one offer than single establishment firms.

Firms that have many job seekers, phoning or visiting them seeking employment, have lower marginal costs for extensive search because it lowers the expected time that a position is vacant if the employer chooses to wait for an additional applicant. As expected, increases in the flow of people contacting the firm seeking work increased, extensive search. A doubling of phone contacts and in person contacts increased the number of applications reviewed per interview by 4 percent and the number of interviews per offer by 3 percent. An increase in the number of visits often reduced the time spent per applicant or per interview, however. The reduction in the cost of extensive search causes extensive search to be substituted for intensive search.

There are a number of reasons why employers can be expected to be more careful when they are filling a job that requires a great deal of on-the-job training. First, much of the training will inevitably be specific to the firm so the cost of turnover will be high and it will pay to seek workers who are unlikely to quit or be dismissed. Second, the distribution of job applicant expected productivities is likely to be more dispersed because some of the job seekers will already have received related training at school or in other firms. Both of these factors raise the returns to employer search. These hypotheses are strongly supported by the data. A doubling of the total amount of training increases the number of interviews per offer by 16 percent and the time spent per applicant by 19.7 percent. The number of applications reviewed per interview are not affected by the amount of training.

Larger physical capital inputs utilized by a worker may directly affect the value of labor services just as the amount of training does. As expected, the greater the expense of the machine the individuals work on or with, the greater the time employers devote to recruiting, screening, and interviewing applicants. Interestingly, the 3 percent increase in direct hiring costs associated with a doubling of the cost of the machines worked on or with occurred because of an increase in intensive search (i.e., in hours spent per applicant). The number of applicants seen was not significantly affected.

The benefits of additional search (both extensive and intensive) arise in part because of the avoidance of mistakes, such as the hiring of an individual whose productivity does not exceed the compensation package promised. If it is difficult to fire a new employee, these mistakes are more costly; as a result, employers will choose more extensive and intensive search prior to hiring. This prediction is confirmed by the evidence. Employers who state that a great deal of documentation or paperwork is required to fire an employee incurred 70 percent greater direct hiring costs, which reflects a 21 percent increase in hours spent per applicant, and a 35 percent increase in applicants per employment offer. Employers who stated that some but not a great deal of documentation or paperwork is required to fire an employee incurred [illegible] percent greater direct hiring costs, which reflects a 22 percent increase in hours spent per applicant, and a 21 percent increase in the number of applicants per employment offer.

The expected tenure and intensity of an employment relationship clearly affect the marginal gain from additional information on potential employees. Thus it can be predicted that positions which are temporary or seasonal in nature and positions that are part-time would be ones for which employers choose less extensive and intensive search. As expected, the number of hours spent per person hired was 36 percent lower if the position was a temporary one, reflecting a 16 percent drop in intensive search (hours spent per applicant) and a 26 percent drop in extensive search (the number of applicants interviewed per offer). Similarly, the number of hours spent per person hired was 22 percent lower if the position was part-time. However, this was due mainly to a drop in the hours spent per applicant. The number of applicants per offer was essentially unchanged, as a fall in the number of applicants interviewed per offer was offset by an increase in the number of applicants per interview.

Having advance notice of a vacancy will presumably reduce the indirect costs of extensive search for the employer, since for a portion of the search time there is no cost to seeing an additional applicant because of the existence of an unfilled vacancy. On the other hand, if the employer has multiple openings, this suggests a greater marginal cost to intensive as well as extensive search. The greater cost for intensive search can be attributed to rising costs for time devoted to hiring activity by company personnel. As expected, advance notice of a vacancy raised direct hiring costs (though the implied sum of direct plus indirect hiring costs was lower), specifically because it raised extensive search (in this case, both the number of applicants seen per interview and the number interviewed per offer were greater). On the other hand, while the existence of multiple openings reduced direct hiring costs, this reflected a fall in the hours spent per applicant.

2.0 WHY DO EMPLOYERS PREFER INFORMAL RECRUITMENT MECHANISMS?

Employers seldom invest in all of the recruitment channels that are available to them. Their decisions about which recruitment channels to emphasize are heavily influenced by their beliefs about where they are likely to find the best workers. Many employers also feel that who made the referral and how the applicant came to hear of the job helps in making a selection amongst the candidates that are interviewed. As a result, even after an application is made, the decision to interview a particular candidate and the selection for hiring may be influenced by who referred the applicant.

These beliefs were put to an empirical test by comparing individuals entering the same job at the same firm who were recruited from different sources. Four questions were explored.

- Is the time required to train new employees associated with the source of their recruitment? If yes, which groups require less training?
- Is the reported productivity of new employees associated with the source of their recruitment? If yes, which groups are more productive?
- Is the wage paid new employees associated with the source of the recruitment? If yes, which groups get the higher wages?
- Does the firm obtain greater profits if it recruits workers from one source rather than another? In other words, is the productivity net of training, recruitment, and wage costs consistently higher for new hires obtained through certain recruitment channels? If yes, which recruitment channel seems to be most profitable?

Theory

The theoretical and empirical issues raised by the first three questions are quite different from the issues raised by the fourth. "Yes" answers to the first three questions are quite consistent with a perfectly competitive labor market where all skills are general and information is costlessly available to everyone. The data suggest that it is not uncommon for people in the same job with the same tenure to receive different wage rates. If the firm can offer different wage rates to different new hires, a perfectly competitive labor market is quite consistent with substantial differences in the expected productivity of the new employees hired for a specific job. If employers' beliefs are correct about the correlation between recruitment channel and productivity of the sample of job seekers that contact them, this same correlation will appear when different workers hired in the same job are compared. Perfect competition implies that the more productive groups will receive higher wage rates and that the higher wage will exactly offset the higher productivity net of training and recruitment costs. If a firm has a policy of not varying the wage rates paid to people in the same job, then perfect and costless information and the absence of specific human capital imply that everyone hired by the firm has the same present discounted expected productivity.

Labor markets, however, are not perfect. Skills are often specific to particular employers, and information about the competence of job applicants is incomplete and costly to obtain. In firms that pay the same wage to everyone, circumstances may, therefore, arise whereby employees recruited from one source (e.g., referral by another employer) are on average more productive than other employees who do the same work and were recruited from another source (e.g., the state employment service). In firms that adjust the entry wage to the perceived competence of the worker, the productivity net of wages, recruitment, and training costs may vary systematically with the recruitment source of the worker.

What kinds of market imperfections can produce variations in the profitability of new hires that are predictable according to the recruitment source of the new hire? The short answer to the question is imperfections that produce a correlation between recruitment source and the employer's monopsony power in hiring that specific individual. Competition forces the firm to offer each worker a compensation package that is at least equal to what the worker can obtain from other firms. A worker with characteristics that are visible to many employers that predict higher productivity in many firms will inevitably receive higher compensation. A worker with characteristics that predict higher productivity in a specific firm but not other firms, or with positive attributes that are visible to only one or two employers, may not receive appreciably higher compensation, and thus may provide the firm an opportunity to receive a profit.

If the recruitment source that yields an applicant is correlated with that individual having a comparative advantage at the jobs in that firm, the result will be a systematic tendency for the recruitment source to relate to the profitability of a new hire. An individual may find a comparative advantage in working at particular firms for a number of reasons.

- A job applicant might already know skills specific to the firm, possibly because of previous employment at that firm or a similar firm, or from being a relative of a current employee.
- A job applicant might have a comparative advantage in learning skills that are specific to the firm, possibly because he or she knows the trainer already.
- A job applicant might enjoy the job more because he or she will be working with relatives and friends and this might result in a higher propensity to stay at this firm. (The effect of recruitment mechanism on turnover is not examined in this study.) Another effect of enjoying the work more might be that the employer can pay a low wage to the new hire.
- A job applicant might have special compatibility with other team members (presumably resulting in greater productivity) possibly because of similar ethnicity or existing friendships with current employees.

The second reason for systematic variation in the profitability of new hires would be the availability to the firm of information about applicants from a particular recruitment source that is not available to other employers contacted by the applicant. Such information allows the employer to make a more refined choice among applicants: avoiding the losers and hiring the winners without having to pay extra. When an employer gets a referral from a current employee or another employer, the person hiring normally receives information about the job applicant that is not available to other employers. As a result, the theory predicts that these new hires will typically be more profitable than other new hires. The state employment service and schools treat all employers equally, so one would not anticipate that hiring such referrals would have this profit advantage for the firm.

Results

Predictions generated by the theory just outlined can be tested by estimating models that characterize how the differences in the training required, reported productivity, and wage rates of two new hires in the same job are affected by the source of recruitment of these new hires. Such predictions do not imply a rejection of a perfect labor market in relation to the impact of recruitment source on the levels of training, reported productivity, and wage rates. They are as follows:

- New hires referred by a union will receive higher wages and be more productive and less costly to train.
- New hires obtained from an expensive referral source (i.e., private employment agencies) will either be more productive, less costly to train, or paid lower wages.
- New hires obtained by referrals from government agencies and schools will be less productive, more costly to train, and paid less.
- New hires referred by another employer will be more productive, less costly to train, and paid more.
- New hires referred by a current employee or who are friends or relatives of a current employee will be more productive and less costly to train.

The results showed that new hires referred by a union received significantly higher wage rates (52 percent for the starting wage), were reported to be significantly (55 percent) more productive in the first 2 weeks, and took significantly (35 percent) less time to train than walk-ins who were hired to do the same work. Employer referrals took significantly (13 percent) less time to train, were 8 percent more productive in the 3rd through 12th week and were paid 7 percent more at the time of the interview. About 30 percent of those hired were friends of the owner or a current employee, and 11 percent were relatives of the owner or a current employee. Friends were reported to be 4 percent more productive during the 3rd through 12th weeks of employment, and 4.4 percent more productive at the time of the study interview. Training time was 4 percent lower and current wage rates were 1.7 percent higher for these employees, but the differences were not significant at the 10 percent level. The only statistically significant effect of being a relative of the owner or a current employee was that wage rates were 5 percent lower.

About 3.7 percent of the new hires had been referred by a school, and another 4.2 percent had been referred by the employment service, CETA, a welfare agency, or the Urban League. The measured effects of being a referral from one of these agencies had the predicted signs in 12 of 14 comparisons. Compared to a walk-in, the productivity net of training costs was 12 percent lower ($p = .133$ on a one-tail test) for school referrals and 14 percent lower ($p = .109$) for employment service referrals.

One of the most interesting findings of the study is the flat rejection of hypotheses about the effect of private employment agency referrals. Such firms generally charge a substantial fee, so it was expected that their referrals would be more productive, require less training, and receive lower wages. Point estimates, however, flatly contradict the first two hypotheses. Agency referrals were reported to be less productive in the first 3 months and to require more training.

The predictions that are unique to the imperfect labor market elements of the theory related to the profitability of a new hire (the difference between productivity net of training costs and the wage) are as follows:

- Union referrals will be less profitable (here it is assumed that some firms are being induced to hire a union referral by threats of a strike).
- Employer referrals will be more profitable.
- Referrals by current employees or friends and relatives of current employees will be more profitable.
- Employment agency referrals will seem to have higher productivity net of wages and training costs. Since the fees paid these agencies are not subtracted, the true profitability of the recruitment source is considerably lower than the measure available.
- Referrals by a government agency will be less profitable.
- Referrals by schools will be less profitable.

The only prediction of the imperfect labor market theory that was rejected by the data was about referrals from private employment agencies. Point estimates imply that such referrals were less profitable by an amount equal to 5.3 percent of the productivity of a worker with 2 years of tenure. The hypothesis that employment agency referrals are sufficiently more productive to warrant a fee of 10 percent of wages was rejected by the data.

The impact of referral source on the profitability of a new hire during the first 3 months (relative to the productivity of a worker with 2 years tenure) was as follows:

Union referral	-29.7 percent (p=.069)
Employer referral	7.1 percent (p=.13)
Friend	2.1 percent (p=.27)
Relative	2.5 percent (p=.305)
School referral	-3.6 percent (p=.26)
Government referral	-8.7 percent (p=.075)

The union referral and employment service referral effects are significant at the 8 percent or better level on a one-tail test, and the employer referral effect is significant at the 13 percent level. The other effects had lower statistical significance. These results are moderate support for the theory developed at the beginning of the discussion.

3.0 ON-THE-JOB TRAINING/SORTING

Every year employers and employees jointly invest a massive amount of resources in on-the-job training (OJT). Despite the importance, however, little is known about its magnitude, distribution, and effects. The training received on a job is part of the understanding (the implicit contract) that defines the nature and compensation of the job. A theory is developed of the determinants of investment in on-the-job training and the compensation package that distributes the costs and returns of the training. The theory assumes that there are (1) two distinct types of skills, general and specific, that are produced jointly; (2) the training firm can accurately measure the amount of general training received by its worker but other firms cannot; (3) workers are not able to borrow money at as attractive rates of interest as their employers (consequently, they make choices between alternative job opportunities placing a very high value on receiving compensation now rather than later); and (4) the compensation offered by a firm has a bigger effect on job seeker's decisions to take a job than on whether to quit a job at a later time. These assumptions about the environment in which training and compensation decisions are made are combined with a model of competitive labor market. We get the following predictions about time pattern of compensation.

- Employers bid for new employees by offering front loaded compensation packages. Since most workers have a stronger desire to have a dollar now rather than later, the firm in effect uses its borrowing power to offer new employees a wage package that pays in advance of performance. Moving allowances are a clear example of this phenomenon, but the same thing is also accomplished by offering higher starting wages and raising wages with tenure by less than the rise in productivity net of training costs. The tendency of firms to front load compensation is greatest when quit rates are not very responsive to the second period wage, and when there is a big difference between the worker's and the employer's ability to borrow.

- Compensation tends to be front loaded if the people who stay at a firm tend to find that the attractiveness of alternative jobs falls with tenure on their current job. The factors that have this effect are costs of job search or job changing; an underestimate by other employers of the amount of general training received; and the tendency of those with the better alternatives or the greater dissatisfaction with their current job to leave, and of those with less attractive alternatives and greater satisfaction with their current job to stay.

- Front loading of compensation is greater when the second period wage has a greater proportionate impact on the probability and the employer will keep a worker that he or she has on the probability the worker will want to stay (i.e., choose not to quit).

- Anything that raises productivity in the firm, but does not raise it outside the firm, will raise the wage in the second period, but not by as much as productivity at the firm increases. Two factors that will produce this effect are training that is specific to the needs of the employer (and not useful to other employers) and the ability of the firm to fire the least productive employees. Here again the result is a front loaded wage package.

- General training, which raises productivity equally both in and out of the firm, results in wages rising along with the rise in productivity net of training costs. Posttraining wage rates will have to be higher, and starting wage rates will consequently be lower.

The Consequences of a Front Loaded Compensation Package

A front loaded compensation package means that at first the firm is investing more in training and in learning about the new employee's productivity. Later in the worker's tenure, these investments pay off and the employee's output exceeds the wages paid. If the worker quits before the return from the investment is recouped, the employer loses money on the hire. As a result, employers offering front loaded compensation packages will tend to give hiring priority to job applicants who are not likely to quit.

The theory predicts that most compensation packages will be front loaded, or in other words that wage rates will rise more slowly than productivity net of training costs when training is entirely general. This prediction contrasts with the predictions of Becker's theory of general human capital, Lazear's agency model, Jovanovic's sorting model, and Salop and Salop's self-selection model. These models all predict that when training is general that wage rates will rise at a rate that is at or above the rate of growth of productivity net of training cost. Data from a sample of 1,493 recently hired workers from the National Center's 1982 survey of employers on training, reported productivity, and wage rates during the first 2 years of tenure on a job were used to test these competing theories.

Employers were asked "How many of the skills learned by new employees in this job are useful outside of this company?" Fifty-nine percent responded "almost all," 13 percent responded "most," and only 7.5 percent answered "almost none." This question provides us with an independent direct measure of the generality of the training provided by a firm. It allows us to test our hypotheses about relative rates of growth of wage rates and training in a sample of jobs that require highly general skills.

The workers in jobs with the most general training seem to receive a real wage increase of 5 to 7 percent. Training for jobs with the most general training and many local competitors involves an average of 49 hours watching others do the job, 9.6 hours in formal training, 52 hours in informal training by management, and 25.6 hours in informal training by co-workers in the first 3 months. The time devoted to training has a value equivalent to 147 hours of an already trained co-worker's time.

This training seems to have the hoped for results of increasing the productivity of new employees. During the first 2 weeks, the typical new employee at firms offering general training is reported to be only 59-60 percent as productive as the typical worker with 2 years of tenure and experience. During the next 10 weeks at the firm, the typical new employee's productivity is reported to be 79 percent that of a worker with 2 years of tenure. As one would expect, the reported productivity of new employees increases more rapidly in the first month or so than it does later. Estimates of the ratio of the worker's productivity net of training costs during the first 3 months to their productivity after 2 years of tenure in the job were made by combining these productivity ratios with the earlier reported estimates of training investments. These figures were then adjusted for the possibility that compensation rises faster than wage rates and for the fact that the time others spend training the new employee during year two were not included in the calculation of the denominator. Our central hypothesis--that productivity net of training costs rises more rapidly than compensation during the first 2 years in a job, even when the training is reported to be completely general, was then tested under a variety of maintained assumptions about the appropriate scaling and measurement of productivity net of training costs.

These tests produced a decisive rejection of the hypothesis that the rates of compensation for jobs reported to offer completely general training rise at a rate that is equal to or greater than the rise in productivity net of training costs. The finding that in the first 2 years of tenure compensation rises less rapidly than productivity net of training costs is quite robust. If compensation rises no more than 5 percent faster than wage rates, the hypothesis is rejected even when we make the truly extreme assumption that, although respondents report to the contrary, there is no increase in worker productivity in the first 2 years on a job. If compensation increases 10 percent faster than wage rates, the hypothesis is rejected even when it is assumed that the true increase in relative productivity with tenure is only half of what was reported by our respondents.

These results can be viewed as evidence that in the first year or so on a job, the forces tending to cause wages to grow more slowly than productivity net of training costs are stronger than those having the opposite effect. This occurs even when the training is reported to be general. The forces that tend to cause starting wage rates to be higher than productivity net of training costs, and therefore wage growth to be slower than the growth of productivity net of training costs, are workers needing and wanting income more strongly now rather than later, than firms and sources of job-worker match specificity such as sorting, costs of transfer, specific training, and extra general training that is not recognized by others in the labor market. The forces that work in the opposite direction are the need to design wage structures to attract those with low quit probabilities (Salop and Salop 1976), and to reduce shirking (Lazear 1981). The great deal of specificity to job-worker matches that is implied by these results means that turnover is extremely costly for the worker, the firm, and society.

The Training Decision

The theory also makes some important predictions about the determinants of investment in on-the-job training:

- Firms and workers will invest more in general and/or specific OJT when interest rates are low, when tax rates on the returns to the investments are low, when separation rates are low, when other employers recognize the value of improvements in the quality of a firm's training, when costs of investment are deductable in the year incurred, and when the tax rates during the investment year are high.
- Decisions about the provision of specific human capital depend upon the tax rates faced by the firm and the interest rate the firm must pay to borrow money. The fact that the costs and benefits of specific human capital investments are shared does not mean that decision making about the amount of specific training is shared. The interest rate the employee must pay to borrow money and his tax situation does not affect the decision.
- When general OJT is perceived accurately by all potential employers, the worker must finance all its costs and it is the interest rates and tax rates faced by the worker, not the firm, that determines whether the investment is undertaken. The impact of these factors on the level of general training is similar to their impact on a young person's decision to remain in school. The primary difference is that generous low interest loans are not available to finance employer-provided general training, as they are for attending institutions of postsecondary education.
- When the quality of general OJT provided by an employer is not accurately perceived by other potential employers, the costs and benefits of the training are shared between employer and employee. Decision-making authority over the amount of training is also shared. The level of investment is influenced by the rates of interest and taxation faced by both the employer and the employee.
- Workers and firms tend to underinvest in general training. This occurs for four reasons.
  - --The worker's discount rate (the rate at which the worker can borrow and therefore trade off future consumption for current consumption) is considerably higher than the social discount rate (the interest rate on government bonds).
  - --The tax rates faced by the worker when the returns to the investment are being received are typically higher than the tax rates when the costs are being incurred.
  - --Other employers do not accurately perceive the quality of the general OJT received by the worker, and as result do not fully compensate the trained worker even if he or she receives good training.

--If a minimum wage constraint is binding, the starting wage on a job will have to be higher than it would otherwise have been and this increases the cost of training and thus reduces its amount. A second impact of the minimum wage is that the rise in the starting wage is partially compensated for by a fall in the wage rate in the posttraining period. This increases the quit rate, which in turn reduces the payoff to training and therefore the amount of training.

If the interest rates facing employers are higher than the social discount rate, there will also be underinvestment in specific training. The degree of underinvestemnt in specific training is considerably smaller than the underinvestment in general training.

From the point of view of public policy, the most important conclusion from the economic analysis of on-the-job training is that from society's point of view, employers and employees underinvest in general on-the-job training. There is a good deal of empirical evidence supporting this finding. If there is underinvestment in general OJT, we would expect to find private rates of return to OJT to be very high. The studies that have estimated the return to OJT do find that rates of return are very high (Rosen 1982, Mincer 1974).

Respondents report that in the 3rd through 12th week of employment, productivity is 16 percent higher on average than in the first two weeks. Since the training that produces this dramatic increase in productivity is occurring over the course of only 2 months, the calculated costs of this training are not likely to exceed 2 months of output from the new worker. If so, the average rate of return to this training exceeds 100 percent.

A different type of evidence for underinvestment in general on-the-job training is provided by finding that employers who hire workers who have already received relevant training at other employers benefit from the hire (Bishop 1982). In other words, OJT creates an externality--a benefit that is not appreciated by either the trainer or trainee.

How might government induce firms and workers to increase investments in general on-the-job training? Four different approaches are evaluated: (1) lower taxes on the returns that the employer receives from training investments, (2) lower taxes on the returns the employee receives from training investments, (3) subsidize the costs of training investments, and (4) abolish the minimum wage for jobs that offer considerable training.

The first two options are not viable because the returns to a training investment cannot be administratively distinguished from the returns of other investments, and general reductions in tax rates (both during and after training) do not increase the incentives to invest in training. It has been demonstrated both theoretically and empirically (Hashimoto 1982, Bishop 1982) that the minimum wage reduces general OJT so reductions in the minimum would increase general OJT somewhat. Eliminating the minimum wage would not however end or even significantly reduce the underinvestment in general OJT. The reason is that the minimum wage is a binding constraint for only a small minority of jobs, and even in its absence, underinvestment in general OJT would occur for a variety of other reasons.

This leaves us with a subsidy of the costs of general training as the only policy that might significantly increase general on-the-job training. Since general OJT typically gets mixed together with specific OJT, and both occur simultaneously with actual production, the primary barrier to subsidizing general OJT is finding a way to measure it. One way society can promote on-the-job skill training without having to solve the measurement problem is for community colleges (or some other public agency) to establish cooperative training ventures with specific local employers in which teachers on the college's payroll provide training that meets that employer's specifications, but is also useful at other firms. The measurement problem can be solved, however, and the final section of this document presents two practical proposals of how general subsidies of on-the-job training might be defined and administered.

Marginal Training Subsidy

A marginal training subsidy (MTS) would offer a partial subsidy of training expenditures above a threshold level. The rate of subsidy or tax credit would be set somewhere between 10 and 33 percent. The training costs that would be eligible for subsidy would include payments to industry training funds, tuition reimbursements for job-related training, contributions of materials or staff time to vocational-technical institutions, the budgeted costs of the firm's formal training of new and continuing employees, and certain costs for informal training of new and upgraded employees.

Participating companies with more than 100 employees would be required to have a training advisory committee that contains worker representation. At the conclusion of the training program or the firm's fiscal year, the employer would be required to award each trainee a certificate describing the number of hours of formal or informal training provided/attended, skills taught and where appropriate, and the competence achieved. The threshold that must be exceeded before a subsidy or tax credit would be paid might be equal to 10 percent of the firm or establishment's wage payments to employees with less than 1 year of tenure at the firm, plus 1.5 percent of wage payments to all other employees.

All employers--profit making, nonprofit and governmental--should be eligible for the marginal training subsidy if their training expenditures exceed the threshold defined for their organization. In order for incentive effects to be maximized, employers must feel they are assured a larger subsidy payment if they increase their firm's training investment. Together these two considerations imply that the MTS should be administered as a subsidy entitlement, as a tax credit against a broad-based tax on the firm's wage bill like Federal Unemployment Insurance Tax or social security tax, or as a tax credit against income taxes that can be sold to other firms. The MTS would be financed either out of general revenue or a special training tax on the wage bill of all employers.

The MTS has a number of important advantages:

- The social benefits of on-the-job training are probably just as large as the social benefits of occupationally specific training provided by schools. The MTS would create an incentive for firms and workers to generate more of such benefits, and would reduce currently prevailing distortions of the choice between these two modes of providing occupationally specific training.
- Since the employer pays 67 to 90 percent of the cost of training, there is always an incentive to do the training in the most efficient manner possible.
- The choice of which jobs to train for and how to do the training is made by the employer not by an educator, a government official, or by the trainee. The employer is the person best able to project the firm's future need for skilled workers and to select the best method of training for those skills.
- The inclusion of the costs of informal training in the definition of subsidizable training expenses is fair to small business, and reduces the tendency of the subsidy to distort choices between formal and informal training.

- While the MTS is not directly targeted on the unemployed dislocated worker, it will reduce unemployment nevertheless. The MTS reduces unemployment in two ways:
  - It encourages firms to hire and train new workers, and to retrain rather than lay-off workers whose skills were becoming obsolete.
  - It encourages the firm to expand the supply of skilled workers rather than engaging in a bidding war for the limited supply of already trained workers, thus producing an acceleration of inflation.
- The MTS should discourage turnover. A firm with high rates of turnover will have a higher threshold, and will as a result receive a smaller subsidy payment.

A Critical Skills Training Incentive

An alternative approach to promoting more private investment in on-the-job training is to target certain critical occupations that are experiencing severe shortages. A subsidy would be offered for training newly hired and/or transferred employees in a few selected occupations. Legislation would restrict the subsidy to a limited number of industries that currently export a major share of their output, or are service firms that provide specialized high-tech services. To be eligible for a training subsidy, an occupation ill would have to involve considerable initial on-the-job training, be required at many firms, and be in shortage. The determination of whether an occupation is in shortage would be based on current data on changes in relative wage rates, changes in vacancy rates or newspaper advertising if available, and on recent and projected growth of demand for the skill. The Department of Labor would be given a fixed budget and empowered to select a limited number of skilled jobs for which training subsidies would be available. Once an occupation had been selected as a potential candidate for subsidy the Secretary of Labor would appoint an industry/labor committee to make recommendations regarding the definition of the critical skill, the competencies that a trained individual would be expected to have, and possible mechanisms to insure that subsidized trainees achieve these standards.

There would be no limit to the number of trainees for which an employer could be subsidized, and the firm would not have to obtain advance agreement from DOL as to this number. The employer would only have to apply for the subsidy immediately upon initiating the training, and once the training is completed, to certify that the trainee did not have that skill prior to the training and gained it by the end of training. This certification would be audited on a random basis. Workers who complete training would be awarded a certificate attesting to the skills they have achieved.

The plan described has a number of attractive features:

- It is limited in scope to occupations in critical shortage.
- Great flexibility is given to program administrators. (This is essential because the very concept of the program is new, and because it must quickly respond to the changing needs of the economy.)
- Workers who complete training are awarded a certificate that describes the skills they have gained.
- The firm always faces a marginal incentive to expand its training of targeted skills. It does not have to get prior agreement from DOL about how many people to train (an administrative hassel that would be a major barrier to participation).
- The firm is given an incentive to retain the workers it trains.
- Despite the almost "entitlement" nature of the training subsidy, its total cost is capped by the monitoring of usage and DOL's ability to lower subsidy amounts and tighten eligibility.
- A sunset provision automatically ends a skill's eligibility for subsidy.
- Cost could be further reduced by requiring that firms already employing people in the targeted skilled occupations exceed a given level of training before being eligible for subsidy. It could be assumed that in the normal course of events such firms would have to replace 10 percent of their stock of workers with the targeted skills anyway. The subsidy could be paid for trainees above this threshold.
- The firm's administrative costs are kept low. The firm does not have to calculate and report how much it is spending on training.
- Eligibility for subsidy is a function of an output--the number of people trained for certain specific jobs--not a measure of input. This creates a strong incentive to be as efficient as possible in doing the training.

The critical skills training incentive has some important drawbacks, however. Its success depends upon the wisdom and timeliness of the selection of skills for which training subsidy is provided. The CSTI has features--the sunset provision, great administrative flexibility, and a fixed budget--that are intended to prevent a recurrence of the poor timing that characterized the graduate fellowships programs. There is always the possibility, however, that the projections of future demand will be wrong, or that politics will result in the wrong occupations being selected and that the selective nature of the training incentive would increase rather than decrease market distortions.

CHAPTER 1

EXTENSIVE SEARCH, INTENSIVE SEARCH, AND HIRING COSTS: NEW EVIDENCE ON EMPLOYER HIRING ACTIVITY

John Barron and John Bishop

1.1 Introduction

Some time ago, Stigler (1961) noted the importance of "the search for information." Subsequent to Stigler's seminal work, an extensive literature on search has developed. With respect to labor markets, the focus has been on characterizing the optimal job search behavior of unemployed or employed workers in an environment in which the job seekers know neither the location of employers who are willing to hire them nor the compensation offers of potential employers. The theoretical work on job search offers explanations for differences across individuals in search intensity, labor force status, and the duration of unemployment. Empirical tests of job search theories typically find the evidence consistent with the job search approach.[1]

One reason to focus on job search is that it plays an important role in the matching of employment positions and workers. In particular, job search increases the likelihood that workers are placed in jobs according to their comparative advantage: workers reap this gain in the form of higher wages obtained through search. Such a view suggests at least an equally important role for employer search, since clearly, it too affects the matching process. Yet, primarily due to the lack of data, research on employer search is not extensive. The purpose of this chapter is to characterize employer search in a simple way and to provide tests of search theory utilizing a unique data set on employer search activity. This can be viewed as a first step toward a more complete investigation of the implications of employer search.

A characterization of search by employers for new employees requires a broader view of search than that suggested by standard search theory. One important change is to recognize that the time spent processing each applicant as well as the number of prospective employees screened by the employer are important measures of employer search activity. As Rees (1966) states, "a buyer can search at the extensive margin by getting a quotation from one more seller. He can search at the intensive margin by getting additional information concerning an offer already received" (p. 560). The organization of the chapter is as follows. Theoretical Framework outlines a model of employer search that incorporates both intensive and extensive search[2] and discusses how these search variables relate to an employer's choices about information production and to the resulting costs of selecting a new hire.[3] The third part of the chapter defines operational measures of intensive search, extensive search, and total hiring costs and describes how these costs vary by industry and occupation. Part 4, Determinants of Employer Search and Hiring Costs, examines the effects of such factors as employer size, dismissal costs, unionization, on-the-job training, adjustment costs, and labor market conditions on intensive search, extensive search, and hiring costs. In the Conclusion, our findings are summarized, a number of implications of the findings are suggested, and future research possibilities are cited.

1.2 Theoretical Framework

Consider an employer who seeks to fill a position. Following Lippman and McCall (1981), it is assumed that the true present value of labor services offered by a new employee, V, is a random variable at the time the decision to hire is made. However, the employer can alter the distribution of V through investments in the screening and interviewing of prospective employees. Following Rees (1966), these investments are categorized as search at the intensive margin and search at the extensive margin. The magnitude of intensive search is measured by the quantity of information gathered concerning a typical applicant. The extent of extensive search is measured by the expected number of applicants seen prior to an employment offer.

The search problem confronting the employer involves the choice of an amount of intensive search and an amount of extensive search that will maximize the expected present value of labor services of the person hired, E(V), minus hiring costs and the present value of compensation paid the new employee. In the remainder of this chapter, we describe the hiring process, indicate what changes in the screening and interviewing procedure of an employer imply concerning intensive and extensive search, and relate intensive and extensive search to hiring costs. The next section introduces empirical measures of intensive and extensive search. The stage is then set for a discussion of the determinants of employer search.

Assume individuals apply for a position at intervals of average length T.[4] The employer screens each job seeker to obtain the set of information denoted by vector I_s. The cost of screening an applicant is denoted by $p_s \cdot I_s$, where p_s is a price vector for the information obtained. The set of information obtained is summarized by an index referred to as the screening index of qualifications.[5] Employers follow the procedure that only individuals with screening indices meeting or exceeding a critical, or "reservation," screening index are offered an interview.[6] Let APERINT denote the expected number of applicants per interview offer; 1/APERINT then indicates the probability that an applicant is interviewed.

During an interview, the set of information denoted by vector I_i is obtained. The cost to the employer to interview an applicant is denoted by $p_i \cdot I_i$, where p_i is a price vector for the information obtained via an interview. The set of information obtained through interviewing is summarized by an index referred to as the interview index of qualifications. Only individuals with interview indices that meet or exceed a critical, or "reservation," interview index are offered employment.[7] Let NINTERVW denote the expected number of applicants interviewed prior to an employment offer.

In the screening and interviewing activities of an employer, an increase in the set of information obtained from each applicant screened, I_s, an increase in the set of information obtained from each individual who is interviewed, I_i, or a decrease in the expected number of applicants per interview, APERINT, implies greater intensive search.[8] Greater intensive search raises the expected present value of labor services provided by the individual who is hired, E(V), by improving the accuracy in predicting the true value of labor services offered. An increase in the expected number of applicants per interview, APERINT, or an increase in the expected number of applicants interviewed prior to an employment offer, NINTERVW, implies greater extensive search.[9] Either change increases the expected number of applicants interviewed prior to an employment offer, NAPPLIC, and thus raises the expected value of labor services supplied by the individual who is offered employment.

Extensive and intensive search affect not only the expected value of labor services of a new employee but also hiring costs. To formalize this, let DCOST denote the expected direct cost of hiring. In general,

(1) $\text{DCOST} = \text{COSTPERA} \cdot \text{NAPPLIC} \cdot \text{NOFFER}$,

where COSTPERA is the expected cost of search per applicant, NAPPLIC is the expected number of applicants per employment offer and NOFFER denotes the expected number of employment offers made in order to hire one individual for the position. An increase in intensive search raises the direct hiring cost by increasing the expected cost per applicant, since

$$(2) \quad \text{COSTPERA} = p_s \cdot I_s + (1/\text{APERINT}) \cdot p_i \cdot I_i.$$

An increase in extensive search raises direct hiring costs by increasing the expected number of applicants per employment offer, NAPPLIC.

When search is undertaken, an employer incurs not only direct but also indirect costs. Let v denote the indirect or opportunity cost per period associated with a position not being filled. The expected indirect hiring cost then equals v times the expected length of time the vacancy remains unfilled. The expected duration of a vacancy is simply the product of three variables: T, the average time between applicants, NAPPLIC, the expected number of applicants per employment offer, and NOFFER, the expected number of offers to fill the position. Thus, indirect hiring cost, ICOST, is given by

$$(3) \quad \text{ICOST} = v \cdot T \cdot \text{NAPPLIC} \cdot \text{NOFFER}.$$

Summing equations (1) and (3), one obtains the expected total cost to fill a position.

1.3 Measures of Extensive Search and Intensive Search

An employer survey sponsored by the National Institute of Education and the National Center for Research in Vocational Education that was conducted between February and June 1982 provides the basis for analyzing employer search and hiring costs.[10] Each employer surveyed was asked about the screening and interviewing activity associated with the last employee hired prior to August 1981.[11] The 2,264 employers who provided answers to a series of questions concerning the last person hired make up the sample of employers whose hiring activity is to be examined.[12] These employers answered questions on the number of individuals who applied for the position, the number interviewed; the hours spent recruiting, screening, and interviewing applicants for the position and the number of offers made. From answers to such questions, measures of extensive search, intensive search, and hiring costs can be computed.[13] Consider first extensive search.

Extensive Search

Extensive search is measured by the number of people who applied for the position per person offered employment. It is computed as the ratio of the employment offers made. This measure of NAPPLIC equals the number of applicants per applicant interviewed, APERINT, times the number of individuals interviewed per employment offer, NINTERVW. Table 1-1 presents the above measures of extensive search categorized by employers' industrial classification and by the occupation of the position filled.

Table 1-1 indicates significant differences in extensive search across positions in different occupations or employers in different industries, differences attributable to differences in likelihood an applicant is interviewed, as well as to differences in the number of applicants interviewed per employment offer. Thus, in the subsequent tests of the determinants of extensive search, the two components of extensive search, APERINT and NINTERVW, are considered separately. A second reason for considering these two components of extensive search separately is that the number of applicants per interview, APERINT, is directly related to extensive search but is inversely related to intensive search. Thus, factors that increase both intensive and extensive search will have an ambiguous effect on APERINT.

Intensive Search

According to equation (2), a variable that reflects intensive search choices is COSTPERA, the average screening and interviewing costs per applicant. A measure of this is the total number of hours spent by company personnel in recruiting, screening, and interviewing divided by the number of applicants for the position. Table 1-1 indicates differences across industries and occupations in hours spent per applicant as well as in total hours spent recruiting, screening, and interviewing applicants. The total hours spent is a measure of the direct cost of hiring, DCOST.

In subsequent discussions, differences in intensive search cost, COSTPERA, will often be cited as evidence of differences in intensive search. From equation (2), this is correct only if we assume that all firms face the same vector of prices, p_s and p_i, for obtaining information during screening and interviewing. Making this assumption, we can obtain evidence on the relationship between intensive and extensive search.[14] Interestingly,

TABLE 1-1

INTENSIVE SEARCH, EXTENSIVE SEARCH, AND HIRING COSTS

	NAPPLIC	NINTERVW	APERINT	COSTPERA	DCOST	Number of Employers	Number of Employees per Employer
Industry							
Mining and agri.	5.64	2.56	2.07	1.48	6.98	42	131
Construction	5.06	3.99	1.76	2.69	8.23	154	38
Manufacturing	13.18	3.97	8.75	2.03	11.64	275	167
Transportation and utilities	10.55	4.41	2.67	2.51	12.42	96	94
Wholesale	8.79	6.19	1.57	2.58	12.81	221	45
Retail	8.12	4.37	2.36	1.53	7.25	712	41
Fin., ins., and real estate	8.04	4.45	1.86	2.61	11.10	165	69
Other services	8.31	4.50	2.17	2.29	10.97	599	46
Total	8.69	4.48	2.93	2.09	9.87	2264	64
Occupation							
Professional or technical	7.03	4.28	1.58	3.34	15.71	183	64
Managerial	7.83	4.05	2.24	3.43	16.99	85	74
Clerical	10.22	5.81	1.98	2.10	12.90	539	66
Sales	9.64	5.19	2.18	2.05	10.60	308	39
Service	8.54	3.86	2.99	1.48	6.30	427	57
Blue-collar	7.77	3.66	4.35	1.99	7.08	722	75
Total	8.69	4.48	2.93	2.09	9.87	2264	64

Note: Since means reported are arithmetic means, the product of the mean of COSTPERA and NAPPLIC does not necessarily equal the mean of the direct cost of hiring even if there was only one employment offer made. Note also that for the same reason, the product of the means of INTERVW and APERINT does not equal the mean of NAPPLIC.

there appears to be a trade-off between intensive and extensive search. Specifically, a 10 percent increase in the number of applicants seen per employment offer implies a decrease in the hours spent per applicant of 3.2 percent.[15]

We now turn to a discussion of how and why extensive search and intensive the direct cost of hiring.

1.4 Determinants of Employer Search and Hiring Costs

Let Z denote a vector of variables that, in influencing an employer's choice of intensive search costs and extensive search (measured by COSTPERA and NAPPLIC = APERINT · NINTERVW, respectively), affect the direct cost of hiring as defined by equation (1). To obtain the effects of changes in elements of Z on intensive search cost, on the components of extensive search, and on direct hiring cost, the following equations are estimated:

(4) $\ln(\mathrm{COSTPERA}) = \partial_c + \beta_c Z + \varepsilon$

(5) $\ln(\mathrm{APERINT}) = \partial_a + \beta_a Z + \varepsilon$

(6) $\ln(\mathrm{NINTERVW}) = \partial_i + \beta_i Z + \varepsilon$

Let the number of offers per person hired be estimated by

(7) $\ln(\mathrm{NOFFER}) = \partial_o + \beta_o Z + \varepsilon$

The logarithm of total hours spent per applicant hired is then estimated by

(8) $\ln(\mathrm{DCOST}) = (\partial_c+\partial_a+\partial_i+\partial_o) + (\beta_c+\beta_a+\beta_i+\beta_o)Z + \varepsilon$

Table 1-2 provides a description of the variables involved in the estimation of equations (4) through (8). Table 1-3 summarizes the discussion to follow and indicates the predicted effect on intensive search cost, extensive search, and the direct cost of hiring of each variable in the vector of independent variables, Z. Table 1-4 presents an estimation of equations (4) through (8). For each variable, its effect on intensive search cost is given by its coefficient in equation (4), the sum of its coefficients in equations (5) and (6) indicates its effect on extensive search, and its coefficient in equation (8) summarizes the net effect on direct hiring cost.[16]

In a recent article on the relationship between employer size and wages, Mellow (1982) suggests that at both the establishment and the firm level, an increase in size "results in increased difficulties in monitoring worker performance" (p. 495). Greater monitoring costs for larger establishments or for firms with more than one plant imply an increase in dispersion in the net expected present value of labor services offered by a new employee. That any

TABLE 1-2

DESCRIPTION OF VARIABLES

Variable Name	Description	Mean[a] (Standard Deviation)
DCOST	Number of hours spent by company personnel recruiting, screening, and interviewing applicants to hire one individual for the position.[b] (total number hours/number hired)	9.87 (17.16)
NAPPLIC	Number of people who applied for the position per person hired (number of applicants/number hired)	9.22 (23.17)
INTERVW	Number of applicants who were interviewed for the position per person hired (number interviewed/number hired)	4.85 (8.55)
NOFFER	Number of applicants who were offered a job per person hired (number of offers/number hired)	1.08 (.42)
COSTPERA	Number of hours spent recruiting, screening, and interviewing per applicant for the position (DCOSTS/APPLIC)	2.40 (4.14)
APERINT	Number of applicants per applicant interviewed for the position (APPLIC/INTERVW)	2.89 (26.58)
NINTERVW	Number of applicants interviewed for the position per offer (INTERVW/OFFER)	4.48 (6.85)
SIZE	Number of full and part-time employees at the establishment during the week of July 1, 1981	63.58 (235.65)
OTHESTAB	Equals one if company has a division or subsidiaries located in other areas	.26
FREQVISIT	Number of people who came looking for work in the past 10 days divided by current employment[c]	.37 (1.01)
FREQPHONE	Number of telephone calls received from people looking for work in the past 10 days divided by current employment[d]	.64 (3.02)
UNION	Proportion of current nonsupervisory workers covered by collective bargaining	.09 (.27)
TRAIN	Measure of the total cost typically incurred to train individual hired for the position during the first 3 months of employment[e]	169.78 (241.49)

Table 1-2--Continued

Variable Name	Description	Mean[a] (Standard Deviation)
PROPGEN	Indicates proportion of skills learned by new employees in the position that are useful outside the company[f]	.70 (.28)
PARTTIME	Equals 1 if usual hours worked per week at the position is less than 30	.14
TEMPSEAS	Equals one if position was supposed to be temporary or seasonal when individual was hired	.15
COSTMACH	Current cost of the most expensive machine people in the position work on or with[h]	24,261.70 (52,751.58)
MULTOPEN	Equals one if there were more than one opening for the position during the period when the individual was hired	.13
ADNOTICE	Equals one if there was any advance notice of the existence of the vacancy that was filled	.53
DIFFIR	Equals one if a great deal of documentation or paperwork is required to fire an employee	.11
DIFFIRS	Equals one if some but not a great deal of documentation or paperwork is required to fire an employee	.20

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[a] Means are for the 2,264 employers in the sample that (a) had one or more employees during the week of July 1, 1981, and (b) provided information on the hiring process associated with the last position filled prior to August 1981 concerning DCOST, number of applicants, number interviewed, number of offers, and number hired. Zero answers for DCOST were assigned the value of one half, as were zero answers with respect to the number interviewed. In the few cases where the number of applicants was less than the number interviewed, the number of applicants was set as equal to the number interviewed.

[b] Concerns last position filled prior to August 1981. Approximately 10 percent of employers hired more than 1 person.

[c] Zero answers to the number of people who came looking were assigned the value of 0.1 (before dividing by current employment). "Don't know"and "not available" were assigned the mean value.

[d] Zero answers to the number of telephone calls were assigned the value of 0.1 (before dividing by current employment). "Don't know" and "not available" answers were assigned the mean value.

Table 1-2--Continued

[e] TRAIN is a weighted sum of the total hours during the first 3 months that the average new employee in the position spends in training activities in which he or she is watching other people do the job rather than doing it her or himself (weight = 0.8), plus the total hours during the first 3 months typically spent on formal training possibly done by specially trained personnel (weight = 1.5), plus the total hours during the first three months that management and line supervisors typically spent away from other activities giving informal individualized training or extra supervision (weight = 1.5), plus the total hours during the first 3 months that co-workers who are not supervisors typically spent away from their normal work giving informal individualized training or extra supervision (weight = 1). "Don't know" and "not available" answers were assigned the mean value. If the sum was 0, TRAIN was assigned the value of 0.5. An upper bound of 520 hours was also set.

[f] Obtained by assigning value of 0.9 to employers who said "almost all", 0.67 to employers who said "most", 0.33 to employers who said "some", and 0.1 to employers who said "almost none". "Don't know" and "not available" answers were assigned the mean value.

[g] For those answering less than 5 or greater than 100, the values of 2 and 115 were assigned. Otherwise, it represents the geometric mean of the interval chosen, where the intervals to choose from were 5-15 and 16-100. "Don't know" and "not available answers" were assigned the mean value.

[h] For those answering less than $2,000 or greater than $200,000, the values of $1,000 and $250,000 were assigned. "Don't know" and "not available" answers were assigned the value of $10,000. Otherwise, the value represents the geometric mean of the interval chosen, where the intervals to choose from were $2-10,000, $10,000- 50,000, and $50,000-200,000.

TABLE 1-3

HYPOTHESIZED EFFECTS OF DETERMINANTS OF EMPLOYER SEARCH AND HIRING COSTS

	Dependent Variable				
Explanatory Variable[a]	Intensive Search Cost ln(COSTPERA)	Applicants per Interview ln(APERINT)	Interviews per Offer ln(NINTERVW)	Extensive Search ln(APERINT·NINTERVW)	Direct Hiring Costs ln(DCOST)
ln(SIZE)	+	?	+	+	+
OTHESTAB	+	?	+	+	+
DIFFER	+	?	+	+	+
DIFFIRS	+	?	+	+	+
ln(FREQVISIT)	-	+	+	+	+
ln(FREQPHONE)	-	+	+	+	+
ln(TRAIN)· PROPGEN	+	?	+	+	+
ln(TRAIN)· (1-PROPGEN)	+	?	+	+	+
ln(COSTMACH)	+	?	+	+	+
PARTTIME	-	?	-	-	-
TEMPSEAS	-	?	-	-	-
UNION	+	?	+	+	+
ADVNOTICE	+	?	+	+	+
MULTOPEN	-	?	-	-	-
ln(NCOMPET)	?	?	?	?	?
ln(NCOMPET)· PROPGEN	?	?	?	?	?

[a] Variables are defined in table 1-2.

TABLE 1-4

ESTIMATES OF DETERMINANTS OF EMPLOYER SEARCH AND HIRING COSTS

		Dependent Variable^a				
Expanatory Variable^b	Mean	ln(COSTPERA) (4)	ln(APERINT) (5)	ln(NINTERVW) (6)	ln(NOFFER) (7)	ln(DCOST) (8)
ln(SIZE)	2.77	-.032	.074	.067	.003	.111
		(1.67)	(6.02)	(3.99)	(.72)	(5.26)
OTHESTAB	.26	.012	.004	.247	-.010	.254
		(.21)	(.12)	(4.93)	(.88)	(4.04)
DIFFER	.11	.192	.122	.181	.033	.528
		(2.25)	(2.28)	(2.44)	(2.04)	(5.69)
DIFFIRS	.20	.201	.008	.185	.024	.418
		(3.26)	(.21)	(3.44)	(2.00)	(6.21)
ln(FREQVISIT)	-2.35	-.048	.037	.031	-.002	.018
		(3.15)	(3.82)	(2.34)	(.55)	(1.09)
ln(FREQPHONE)	-2.13	.004	.018	.013	.002	.037
		(.27)	(2.05)	(1.09)	(.81)	(2.44)
ln(TRAIN)· PROPGEN	3.07	.146	-.011	.103	.006	.244
		(7.04)	(.82)	(5.69)	(1.47)	(10.79)
ln(TRAINO· (1-PROPGEN)	1.28	.135	.011	.110	.004	.260
		(4.40)	(.56)	(4.12)	(.66)	(7.77)
ln(COSTMACH)	8.59	.029	.010	-.002	-.009	.036
		(1.98)	(1.11)	(.14)	(.32)	(2.29)
PARTTIME	.14	-.218	.127	-.184	.020	-.256
		(3.13)	(2.89)	(3.03)	(1.47)	(3.36)
TEMPSEAS	.15	-.181	.029	-.305	-.011	-.468
		(2.70)	(.69)	(5.24)	(.87)	(6.41)
UNION	.09	-.217	.242	-.259	-.032	-.265
		(2.36)	(4.18)	(3.23)	(1.83)	(2.65)
ADVNOTICE	.53	.017	.093	.205	.001	.316
		(.37)	(3.17)	(5.07)	(.12)	(6.24)
MULTOPEN	.13	-.149	.074	-.100	.051	-.123
		(2.70)	(1.66)	(1.63)	(3.79)	(1.59)

Table 1-4--Continued

		Dependent Variable[a]				
Expanatory Variable[b]	Mean	ln(COSTPERA) (4)	ln(APERINT) (5)	ln(NINTERVW) (6)	ln(NOFFER) (7)	ln(DCOST) (8)
ln(NCOMPET)	3.03	-.042	-.006	.061	.005	.014
		(1.08)	(.24)	(1.80)	(.07)	(.32)
ln(NCOMPET)· PROPGEN	2.22	.034	.011	.039	.003	.087
		(.68)	(.56)	(.90)	(.34)	(1.59)
Constant		-.741	.076	.008	.008	-.650
		(4.52)	(.73)	(.06)	(.25)	(3.64)
R^2 (adjusted)		.05	.06	.14	.01	.24
Std. error		1.09	.69	.95	.21	1.19

[a] The mean of ln(DCOST) is 1.39. The mean of ln(COSTPERA) is 0.067. The mean of ln(APERINT) is 0.35. The mean of ln(NINTERVW) is 0.91. The mean of ln(NOFFER) is 0.05. The absolute values of the t-statistics appear in parentheses. Regression results are for a sample size of 2,264 employers.

[b] Variables are defined in table 1-2.

mistake in hiring is likely to impose greater costs at larger firms leads larger firms to exercise more care in selecting new employees. Thus it is hypothesized that extensive search, intensive search cost, and direct hiring cost will be greater at larger firms. Ambiguity does exist with respect to the predicted effect of firm size on the number of applicants seen per interview, since it is negatively related to intensive search but positively related to extensive search.

The above hypotheses were tested by examining the effect of two measures of size, ln(SIZE) and OTHESTAB. ln(SIZE) denotes the logarithm of the number of employees at the establishment as of July 1981. OTHESTAB is a dummy variable equal to one if the company has other divisions or subsidiaries located out of the area.

The evidence indicates that employers of larger establishments do, in fact, engage in more extensive search. A doubling in the establishment size increases both the number interviewed per offer and the number of applicants per applicant interviewed by approximately 5 percent, and thus increases the number of applicants per offer by approximately 10 percent. However, the number of hours spent per applicant unexpectedly falls by over 2 percent. The net effect on the direct cost of hiring is that it increases approximately 8 percent with a doubling in the size of the employer. Consistent with greater monitoring costs, companies having other establishments outside the area have 29 percent higher direct costs, reflecting greater extensive search, specifically an increase in the number of applicants interviewed per offer. Intensive search in terms of the number of hours spent per applicant is not changed by being part of a larger company.

These findings, although, in general consistent with the theory, have two peculiarities: the large positive effect of establishment size on the number of applicants per interview and the negative effect of establishment size on intensive search cost. This suggests a second complementary rationale to explain why larger establishments invest greater resources in recruiting and selecting workers. Specifically, assume that larger establishments are more likely to have individuals who specialize in the screening of applicants. Due to specialization, the price vector for information obtained from each applicant, p_s, is lower.[17] According to equation (2), a lower p_s reduces the marginal cost of information obtained on each applicant, I_s. One thus expects I_s to increase, and this increased information obtained at the application stage to substitute for information gathered via an interview. This leads to the prediction that larger establishments will gather less information by interviews and will have a lower probability of interviewing an applicant (i.e., an increase in the expected number of applicants seen per applicant interviewed). The net effect on intensive search cost, COSTPERA, is unclear, although a reduction is now not unexpected.[18]

Lippman and McCall (1981), in examining the implications of the existence of belated information on the optimal search strategy, argue that in environments in which belated information exists (in our case, information is obtained by the employer on the productivity of the new employer after the hiring decision is made), if turnover is not permitted then the "searcher. . . is more careful in his irrevocable decision making" (p. 142). Thus, independent of any difficulties in observing a worker's contribution, if employers find it difficult to react to a mistake (i.e., to fire an individual whose discovered productivity does not exceed the compensation package), then mistakes will be more costly. As a result, such employers are hypothesized as engaging in more extensive search and intensive search prior to hiring, and thus incur greater direct hiring costs.

The predictions of the effects of firing difficulties on employer search and hiring costs are confirmed by the evidence. Employers who state that a great deal of documentation or paperwork is required to fire an employee (DIFFIR = 1) have a 70 percent higher direct cost of hiring. This reflects a 21 percent increase in hours spent per applicant and a 35 percent increase in applicants per employment offer. Employers who state that some but not a great deal of documentation or paperwork is required to fire an employee (DIFFIRS = 1) incur 52 percent greater direct hiring costs. This reflects a 22 percent increase in hours spent per applicant and a 21 percent increase in the number of applicants per employment offer.

Mortensen (1970) argues that one response of an employer to an increase in output demand is to lower the minimum skill requirements in hiring. One would predict changes in labor market conditions to have similar effects on employer search. At the time of the survey each employer was asked "during the past 10 days, how many telephone calls did you and your personnel office receive from people seeking work" and "during the past 10 days, about how many people came to your company looking for work." Division of each of these by the current number of employees and taking the logarithm generates two measures, ln(FREQPHONE) and ln(FREQVISIT), of the flow of individuals seeking work at the firm at the time of the survey. If differences across employers in ln(FREQPHONE) and ln(FREQVISIT) tend to remain constant over time, then these variables indicate the flow of applicants to the employers at the time a new employee was hired.[19]

An increase in the flow of applicants to an employer reduces T, the average time between applicants. According to equation (3), a reduction in T lowers the increment in the indirect cost of hiring to an increase in extensive search in terms of the expected number of applicants per employment offer, NAPPLIC. Thus, we hypothesize that the components of extensive search are related directly to ln(FREQPHONE) and ln (FREQVISIT), as employers raise their minimum skill requirements in response to an increased flow of applicants. On the other hand, intensive search costs are expected to fall with increases in ln(FREQPHONE) and ln(FREQVISIT), as extensive search is substituted for intensive search. The net effect on the direct cost of hiring is ambiguous, although the sum of direct and indirect hiring costs must fall.

The evidence indicates that extensive search does increase with an increase in FREQPHONE and FREQVISIT. However, an increase in the rate of telephone calls increases the number of applicants per interview but not the number of interviews per employment offer. On the other hand, an increase in the rate of visits by job seekers increases not only the number of applicants per interview but also the number interviewed per employment offer. Thus, as one might expect, employers' extensive search choices are more responsive to changes in the number of individuals who visit the employer seeking work than to changes in the number who telephone the employer seeking work. This is also true with respect to the substitution of extensive search for intensive search. A greater flow of applicants visiting the employer reduces the average time spent with each applicant, while a greater rate of telephone calls does not significantly alter the investment in intensive search.

Now, consider the effects of on-the-job training. If training is important, there will be greater dispersion in the distribution of the present value of labor services offered by individuals applying for a particular position. Since the wage profile specified for the position does not perfectly reflect the actual increases in productivity, increased training implies a larger gain to additional information gathered by intensive and extensive search. We therefore hypothesize that the firm will be more careful in selecting new employees when the job requires a great deal of on-the-job training. Let ln(TRAIN) denote the logarithm of the weighted sum of different types of informal and formal training typically associated with the position during the first 3 months of employment.[20] The prior discussion leads to the hypothesis that ln(TRAIN) is directly related to extensive search, intensive search, and the direct cost of hiring.

The variance of the difference between the value of labor services received and the wage paid will be particularly great if the training is specific to the firm.[21] Thus training that is predominantly specific to the firm should lead the firm to take great care in hiring and engage in extra extensive and intensive search. Thus, in estimating equations (4) through (8), ln(TRAIN) is interacted with PROPGEN and (1 - PROPGEN), where PROPGEN denotes the proportion of skills lerned by new employees in the position that are useful outside the company.

The evidence indicates that an increase in either general or specific training raises the direct cost of hiring by increasing extensive and intensive search. Unexpectedly, the effects of specific and general training on intensive and extensive search are very similar. The number of applicants per employment offer rises approximately 1 percent given a 10 percent increase in either general or specific training, while the hours spent per applicant rise by over 1 percent given a 10 percent increase in either general or specific training. One interpretation of general training having an effect similar to specific training on hours spent per applicant is that, with general training, the hours spent reflect not only greater employer search but also the increased gathering of information by applicants on the investment opportunity (general training) offered.

Like training, larger physical capital inputs utilized by a worker may increase the dispersion in the net present value of labor services offered. A measure of the physical capital input, COSTMACH, is computed from the answer to the question "if it were purchased today, what would be the cost of the most expensive machine people in this position work on or with." As expected, the greater the expense of the machine individuals work on or with, the greater the time employers devote to recruiting, screening, and interviewing applicants. Interestingly, the close to 3 percent increase in direct hiring cost associated with a doubling in the cost of the machines worked on or with occurs primarily due to an increase in intensive search (i.e., in hours spent per applicant). The number of applicants seen is not significantly affected.

Other variables that are directly associated with the dispersion of the net present value of labor services offered are the expected tenure of the employment relationship and the intensity of the employment relationship. PARTTIME denotes a position in which a typical week is less than 30 hours and TEMPSEAS denotes a position that is temporary or seasonal in nature. We hypothesize that either variable will be inversely related to intensive search, extensive search, and direct hiring cost.

As expected, the number of hours spent per person hired is 23 percent lower if the position is part-time. This reflects a 20 percent drop in intensive search costs (hours spent per applicant) and a 6 percent drop in extensive search (the number of applicants seen per offer). Note that the fall in extensive search reflects a drop in the number of applicants interviewed per offer that offsets an increase in the number of applicants per interview. Similarly, hours spent per person hired is 37 percent lower if the position is a temporary one. This is due to a drop in the hours spent per applicant of 17 percent and a fall in the number of applicants per offer of 24 percent.

Brown and Medoff (1978) suggest that employers may respond to the higher employee compensation package imposed by a union by hiring higher-quality workers. They express reservations concerning this view, but suggest that the issue "should be studied in greater detail, (in part by utilizing) data sets which provide additional measures of labor quality" (p. 375). The variable UNION denotes the reported proportion of workers covered by collective bargaining agreements. An increase in the proportion covered is likely to reflect an increased probability that the position filled is a unionized position. Following Brown and Medoff, we hypothesize that the variable UNION should be directly related to extensive search, intensive search, and direct hiring cost, as employers seek higher-quality workers for unionized positions.

Surprisingly, the evidence indicates that direct hiring costs are lower for unionized jobs, due to reductions in the hours spent per applicant, the number interviewed per offer, and the number of offers per hire. Offsetting this to some degree is a higher number of applicants evaluated per applicant interviewed.[22] Potential explanations of this are (1) search activity by the union has been neglected; (2) self-selection occurs whereby only high quality job seekers apply because unionized employers are known to hire only high quality individuals; and (3) the higher compensation of unionized positions alters the behavior of workers (i.e., reduces the likelihood of quitting) in such a way that it reduces the gain to additional search that derives from discovering individuals possessing preferred characteristics (i.e., greater employment stability).

Advance notice of a vacancy (ADVNOTICE = 1) means that for at least a while extensive search incurs no indirect costs. This should allow the firm to review more applications and interview more people. As expected, advance notice of a vacancy raises direct hiring costs (although the implied sum of direct plus indirect hiring costs is lower), specifically by raising extensive search--both the number of applicants seen per interview and the number interviewed per offer.

There is likely to be diminishing returns to recruitment investments and intensive search, so employers with multiple openings (MULTOPEN = 1) will face high marginal search costs and consequently invest less in search. Unexpectedly, the existence of multiple openings does not significantly reduce extensive search. However, the existence of multiple openings does reduce the hours spent per applicant. It is evident that less is invested in search prior to an employment offer when the employer has multiple openings. This is consistent with the hypothesis that higher adjustment costs are associated with a more rapid increase in employment (see, for example, Mortensen 1973). This follows since the reduced care taken to locate an acceptable new employee by a firm with multiple openings imposes costs on the firm in terms of a lower expected contribution to output from the additional worker.

Two variables whose effects are difficult to predict are the logarithm of the number of other employers in the area who require skills learned by the new employee, ln(NCOMPET), and this variable weighted by the proportion of skills learned that are useful outside the company, ln(NCOMPET) · PROPGEN. One could argue that the greater ln(NCOMPET), and especially ln(NCOMPET) · PROPGEN, the greater the flow of potentially qualified applicants to an employer. This implies lower costs for increased extensive search. On the other hand, the increase in the number of alternative employers who require the skills taught by the employer would tend to increase the likelihood of quits, reducing expected tenure, and thus, the gains to extensive and intensive search by the employer. Yet, the increase in the number of such alternative employers might increase not only the mean quit probability of an applicant but also the dispersion of this quit probability across potential applicants. This would provide an incentive for the employer to seek additional information on applicants to alter the quit probability. The evidence is that neither variable has a significant effect on intensive search costs, extensive search, or the direct cost of hiring.

The specification of equations (4) through (8) reported here excludes occupational and industrial dummy variables, since no immediate justification for their inclusion is apparent. Specifications including occupational and industrial dummy variables were also estimated and the findings remained essentially unaltered.[23] The search process to fill a managerial or professional/technical position is considerably more intensive (50 percent) than the process for filling a blue collar position. It is not, however, more extensive: the number of applicants per interview and the number of interviews per offer are essentially the same. Filling a clerical position typically requires 17 percent more time per applicant and 40 percent more interviews per offer than filling a blue collar position. Sales positions do not require a more intensive search process but the number of interviews per hire are typically 28 percent higher than for blue collar positions. The extent and intensity of the search process for a service occupation is very similar to that for a blue collar position.

1.5 Conclusion

In the labor market, the screening and interviewing activity of employers prior to a new hire plays an important role in determining the matching of workers across firms and tasks. Hiring costs also determine to some degree the fixity of labor. Yet, with the notable exception of Rees and Shultz (1970), a systematic study of employer search activity and hiring costs has been lacking. Utilizing an extensive new data source that was designed in part to solicit information on the nature and degree of employer search, this chapter fills the void. While many unanswered questions remain, the following findings have emerged:

- Employers engage in both extensive and intensive search, which involves an average nine applicants per job offer and spending per appliant over two hours of company personnel time in recruiting, screening, and interviewing activities.
- Employers appear to trade off intensive and extensive search.
- Larger employers engage in more extensive search (more applicants per offer) but less intensive search (fewer hours spent per applicant). Total hours spent to fill a position are on net higher for larger employers.
- Increases in the flow of job seekers phoning or visiting the firm result in greater extensive search, with some substitution of extensive for intensive search.
- Employers choose less intensive and extensive search to fill part-time and temporary or seasonal positions.
- Employers offering more training search both more extensively and intensively.
- Employers with a greater proportion of their work force unionized spend fewer hours searching, although they do see more applicants per interview.
- Employers with advance notice of a vacancy search more extensively.
- Employers who face greater costs of discharging employees are more careful about who they hire and demonstrate this by investing greater resources in both extensive and intensive search.

The important implication of these findings for the management of schools will be discussed in chapter 4 so they are not developed here. The study also has a number of implications for general research on the job search/hiring process. For instance, the evidence presented in this chapter suggests that the higher wages occurring at larger plants and at larger firms is in part due to a propensity to hire workers of higher quality--as indicated by the greater search undertaken by such employers. The effect of size is strengthened if there are controls for industry and occupation, a doubling of establishment size increases direct hiring costs by approximately 14 percent, the number of applicants seen per interview by 6 percent, and the number of individuals interviewed per employment offer by 7 percent. Firms with more than one establishment incur 40 percent higher direct hiring costs, reflecting again greater extensive search.

Employer search appears to be no greater for union than for non-union workers. This result is consistent with Brown and Medoff's evidence that union workers do not differ in quality from nonunion workers. Finding a positive relationship between the difficulty of firing a worker and employer search provides support for the belated information search theory offered by Lippman and McCall. The fact that employers are less careful in screening applicants when faced with a lower applicant flow supports Mortensen's hypothesis of changes in hiring standards in response to changes in output or labor market conditions. The less careful search by employers with multiple openings provides evidence of labor adjustment costs that increase with the rate of change in employment. Finally, the evidence that positions involving greater training are positions for which employer search is greater suggests one must be careful in interpreting the results of training, either general or specific, on the wage profile. Specifically, we argue that increased training raises the gains to a more careful search if training and ability are positively correlated. Thus, a comparision of the experience of two individuals with different on-the-job training will tend to overstate the return to the additional training since the individual who receives greater training is likely to have been more carefully selected by his or her employer (and therefore of somewhat greater ability).

There are at least two important extensions to the analysis in this chapter. First, we have attempted to quantify in a simple way the complex information-gathering activity of an employre prior to hiring. Important attributes of this search process are thus neglected. For instance, our measure of intensive search, hours spent per interview, ignores differences in information about an applicant that might arise given the source of applicants. Thus, our analysis cannot take into account Granovetter's (1974) suggestion that information available on an applicant is viewed by employers as "better" if the individual became acquainted with the job opening by "personal contact" (e.g., is a referral from a current employee). This possibility is examined in the next chapter.

A second important extension of the analysis in the paper is suggested by its focus on differences in the resources employers devote to the search for new employees. Suppliers of labor also incur costs to locate a suitable employer, and these search costs contribute to the degree of fixity of labor as well. For instance, Barron and Mellow (1979) discuss differences in hours per week unemployed job seekers spend searching. Granovetter, in a more indepth study, considers the various methods job seekers employ to obtain information leading to employment. An extension of work in this area would involve a shift in focus away from either employer hiring activity or worker job-seeking behavior to consider the job-matching process and the interrelations that develop in the matching of jobs and workers. The recent theoretical paper by Ramaswami (1983) is an important contribution to this endeavor. It is interesting to note that our preliminary finding (see footnote 23) of a positive correlation between the starting wage and employer extensive search, other things equal, is consistent with Ramaswami's hypothesis that employers who engage in more extensive search must compensate applicants for the reduced probability of an employment offer.

FOOTNOTES

1. Recent empirical tests of job search theory include Black (1980), Yoon (1981), Kahn and Low (1982), and Flinn and Heckman (1983).

2. The model draws upon the recent work in search theory by Lippman and McCall (1981), which considers search when information is incomplete at the time the decision to act (in our case, hiring a new employee) is made. Other theoretical papers that address this issue in the context of job search include Johnson (1978) and Borjas and Goldberg (1978).

3. Walter Y. Oi (1960), in a seminal paper, develops the implications of fixity of the labor input. Analogous to Tobin's "q" in capital investment decisions, Oi's "q" measures the degree of fixity of the labor input by the difference between an employee's value of marginal product and the wage. This discounted difference reflects, in part, hiring costs.

4. Specifically, it is assumed the length of time between applicants is exponentially distributed, with θ denoting the constant probability of an individual applying for employment during a very small time interval and $T = 1/\theta$.

5. Typically, this information is obtained from an application form. The choice of information that makes up a set of qualification measures and the method of combining such information into a one-dimensional measure to aid in the prediction of V are optimization problems not dealt with in this paper. The screening literature argues that education may be one variable that enters such an optimization problem (see, for example, Spence 1973 or Stiglitz 1978).

6. It is assumed that the expected value of labor services offered by individuals with a screening index of qualifications, $Q_s(I_s)$, at least as great as the reservation screening index, q_s^*, is increasing in q_s^*. That is, $\partial E(V|Q_s(I_s)\geq q_s^*)/\partial q_s^*>0$. The sequence of screening applicants prior to interviewing implies that the cost to an employer of aninterview is high relative to the cost of screening an applicant using an application form.

7. It is assumed that the expected value of labor services offered by individuals with an interview index of qualifications, $Q_i(I_i)$, at least as great as the reservation interview index, q_i^*, is increasing in q_i^*. That is, $\partial E(V|Q_i(I_i)\geq q_i^*)/\partial q_i^*>0$.

8. A decrease in the expected number of applicants per interview reflects a decline in the reservation screening index. It is assumed that in the screening and interviewing process, decision rules made prior to search with respect to information sets and reservation qualification indices are not altered during the hiring process.

9. An increase in APERINT reflects an increase in the reservation screening index, while an increase in NINTERVW reflects an increase in the reservation interview index of qualification. Note that an increase in APERINT, holding constant NINTERVW, implies that the reservation

interview index of qualifications, q_i^*, is appropriately changed (increased), since with more extensive screening it is more likely that an individual interviewed will have qualifications that equal or exceed a given reservation interview index of qualifications.

10. The survey represents the second wave of a two-wave longitudinal survey of employers from selected geographic areas across the country. The first wave, not utilized in this study, was funded by the U.S. Department of Labor to collect data on area labor market effects of its Employment Opportunity Pilot Project (EOPP). The survey encompassed 10 EOPP pilot sites and 18 comparison sites selected for their similarity to the pilot site. The survey design specified a strategy of oversampling firms with a relatively high proportion of low-wage workers. The second wave made an attempt to interview all of the respondents in the first wave survey. About 70 percent of the original respondents completed surveys for the second wave. The data collected by this second wave survey on the circumstances surrounding a recently hired worker are more extensive than those available in the first wave, or in any other data set known to the authors.

11. In the bulk of the sample, the respondent was the owner/manager of the establishment. In large organizations, the primary respondent was the person in charge of hiring, generally the personnel officer. When the primary respondent was unavailable to answer a question, he or she was asked if someone else in the organization would have the information and that part of the interview was completed with this other official. Other respondents were controllers, wage and salary administrators, and line supervisors (for questions about a particular recent hire). A copy of the complete questionnaire as well as other related information is available on request from the authors.

12. A total of 447 employers responded that they had hired a new employee but did not have complete information on the hiring process, and so were excluded from the sample.

13. Note that the sample is representative of the hiring activity of a group of employers, not the hiring activity associated with the employment of a group of job seekers during a specified time frame. The sample most likely underrepresents larger employers if the employment of a group of job seekers over a specified period of time were to be considered.

14. Specifically, assume the relationship between intensive and extensive search is of the form $\text{COSTPERA} = {}^{a}(\text{NAPPLIC})^{\eta}$. If the intensive and extensive search choices are not correlated, then $\eta = 0$ and an estimation of the logarithm of equation (1), excluding ln(COSTPERA), should yield a coefficient on ln(NAPPLIC) not significantly different from 1. This presumes ln(NOFFER) is independent of the other components of direct hiring costs. On the other hand, if there is an inverse relationship between intensive and extensive search ($\eta < 0$), then the estimated coefficient on ln(NAPPLIC) should be significantly less than 1; 1 minus the coefficient then provides an estimate of η, the elasticity of substitution between intensive and extensive search. The regression

results are

$$\ln\left(\frac{DCOST}{NOFFER}\right) = \underset{(.032)}{.47} + \underset{(.018)}{.65}\ \ln(NAPPLIC)$$

$$\bar{R}^2 = .38$$

$$N = 2264$$

where the numbers in parentheses are standard errors.

15. Note that to some extent the existence of measurement error strengthens the claim of a trade-off between intensive search and the extensive search. This follows since NAPPLIC is computed as the ratio of the total number of applicants to the number of offers; thus, measurement errors can bias the coefficient on ln(NAPPLIC) toward one.

16. Note that regression (8) provides no new information over that contained in regressions (4) through (7).

17. This approach to the effect of firm size is suggested in Barron and Mellow (1982).

18. The increase in the expected number of applicants seen per applicant interviewed will increase extensive search; however, unless COSTPERA falls dramatically, this argument suggests a fall in the number interviewed.

19. The variables we would prefer to include in the regression are the *autonomous* flow of job seeker contacts *at the time of the hiring event*. By autonomous we mean uninfluenced by the firm's recruitment policies. In fact, however, the time period for which the flow of job seeker contacts is measured is between 6 and 24 months after the hiring event being studied, and these flows respond both to the long term recruitment policies (e.g., whether applications are stockpiled, choice of advertising mode when there is a vacancy) of the firm and the employers current circumstances and behavior (e.g., number of vacancies, recent advertising efforts, whether phone callers are being encouraged to visit) (see Bishop, Barron, and Hollenbeck 1983). If these flows had been measured at the time the hiring decision was made, there would have been an endogeneity problem that would have positively biased their coefficients (employers that wanted to engage in a very extensive search may invest in greater advertising to generate a larger flow of job seekers). Since, however, the time periods are so different, the negative bias produced by random measurement error is likely to be much more significant than the positive bias introduced by endogeneity. Dropping FREQPHONE and FREQVISIT from the regressions does not significantly alter our other findings.

20. The construction of these two variables is described in table 1-2. The weights chosen for the different components of training reflect hypothesized relative costs. Note that the effect of training is not sensitive to changes in the weights or to the interacting of training with PROPGEN. Specifically, each component of training has a significant positive effect on the direct cost of hiring.

21. Note it is assumed that even our measure of general training is not completely general since costs exist with respect to the providing of information to other employers on the outcome of one employer's training on productivity. The general training models typically downplay the pervasive nature of such informational costs. For evidence that individual differences in productivity at a firm are not fully reflected in the compensation awarded the individual, see Bishop and Stevenson (1982).

22. Note that the effect of UNION is not significantly changed if industry and occupation variables are included, nor if a variable interacting the construction industry with the union variable is included.

23. Also excluded from the regression results reported were estimations that included variables indicating the existence of a probationary period, the duration of a probationary period, the annual quit rate for the employer, and the starting wage. These variables are excluded since it is felt that endogeneity problems are more severe with such variables. Inclusion of the first three variables does not alter the reported results. Interestingly, the lack of a probationary period has no association with the direct cost of direct hiring because a rise in the hours spent per applicant is offset by a fall in the number of applicants per employment offer. For employers with a probationary period, an increase in the duration of the probationary period is associated with higher direct-hiring costs as employers spend more hours with each applicant. Surprisingly, differences in quit rates across employers are uncorrelated with differences in search behavior. On the other hand, a 10 percent increase in the starting wage is correlated with an increase in the direct cost of hiring of 3.2 percent, even though the number interviewed per offer is 2.2 percent lower; more than compensating is a 6 percent increase in hours spent per applicant (intensive search costs). With the inclusion of starting wage, ln(COSTMACH) no longer significantly affects the direct cost of hiring.

CHAPTER 2

WHY DO EMPLOYERS PREFER INFORMAL RECRUITMENT MECHANISMS?

John Bishop

2.1 Introduction

A number of studies have found that one of the most effective methods of obtaining a job is to apply at firms suggested by friends or relatives. Even though only 14 to 17 percent of unemployed job seekers and 18 percent of employed job seekers are using this method at any point in time, 26 percent of all workers reported that they found their job through a contact suggested by a friend or relative (Rosenfeld 1975, see table 2.1). In the National Center employer survey, 41 percent of a random sample of recent new hires were friends or relatives of the owner, a current employee, or referred by a friend or relative. In the Employment Opportunity Pilot Project household survey, friends and relatives suggested only 8.8 percent of the employer contacts made by job seekers, but these contacts were responsible for 17.6 percent of the jobs that were obtained.

These studies have also found that making applications through the employment service is a rather ineffective method for obtaining work. Even though 28 to 33 percent of unemployed job seekers and 25 percent of employed job seekers report using the employment service, only 5.1 percent of those with jobs reported they found their last job through a referral from the employment service. Referrals by private employment agencies and schools also account for only a small number of the jobs that are found. Of firms with one or more vacancies at the time of the interview, only 21 percent had listed their job with the employment service at some time in the previous 2 weeks and only 17 percent had listed it with either a union or a private employment agency. In contrast, 48 percent of the employers had announced their vacancies to current employees and 44 percent had not requested any referrals and had neither announced nor advertised their vacancy.[1]

Employers invest resources in the recruitment and selection process because they expect it will enable them to hire better workers. Choosing the optimal mix of recruitment strategies involves weighing the benefits (i.e., high-quality workers) of each strategy against its cost. Employers seldom invest in all of the recruitment channels that are available to them. One factor that may contribute to the employer preference for informal over formal recruitment channels is the lower cost of informal recruitment channels. A

TABLE 2-1

JOB FINDING METHODS

	Percent Finding Job by this Method		Percent Using Method					
	1981 Employer Survey[a]	1973 Worker Survey[b]	Job Finders 1973[b]	Employed Job Seekers[c]	Unemployed Job seekers 1/74[d]	3/83[d]	Percent of All Contacts[e]	Ratio of Contacts to Jobs Found[e]
Friend								
Job at their firm	31.4	12.4	50.8					
Other job	N/A	5.5	41.8					
Relative				17.9	13.7	17.3	8.8	23
Job at their firm	10.1	5.1	28.4					
Other job	N/A	2.2	27.3					
Apply Directly	24.8	34.9	66.0	69.9	70.5	79.6	38.4	51
Newspaper Ad	11.8	11.8	50.0	25.3	28.0	33.3	31.5	96
Employment Service	3.6	5.1	33.5	10.4	26.1	24.2	10.5	29
Private Empl. Agency	2.7	5.6	21.0	5.5	8.8	5.5	2.2	32
School	3.7	3.5	12.5				1.1	20
Union	.7	1.5	6.0	6.9	8.2	5.0	.9	24
Employer	5.6	N/A	N/A				N/A	N/A
Other	5.6	11.4	N/A				6.7	35
Total	100	100					100	

---

[a] National Center Employer Survey
[b] Rosenfeld (1975, pp. 39-43).
[c] Rosenfeld (1977, pp. 58-62).
[d] Employment and Earnings (1974, table A 15); Employment and Earnings (1983, table A 19).
[e] Tabulations of the Employment Opportunity Pilot Project Household data graciously provided by Mike Keeley of SRI International.

good measure of hiring cost is the total number of hours spent recruiting, screening, and interviewing to fill one position. There is a strong relationship between the measure of hiring costs and the recruitment source of the person hired (see table 2-2).

TABLE 2-2

HIRING COST BY RECRUITMENT SOURCE[2]

Recruitment Strategies	Hours	T-Statistic for Difference from Walk-in
Union referral	3.8	2.86
Relatives of current employee	6.1	4.33
Friends of current employees	8.3	1.24
Walk-in	9	--
School referral	11.2	1.67
Employer referral	12.0	2.59
Employment service referral	14.8	3.71
Private employment agency referral	15.6	3.56
Other government agency referral	17.9	3.71
Newspaper ad	21.9	10.35

Note: Hours spent recruiting, screening, and interviewing were predicted as a function of recruitment source while holding constant the following variables: employer size, flow of job seeker contacts, unionization, intensity and generality of OJT, part time or temporary job, and job security policies. For walk-ins the arithmetic mean of hiring cost was approximately 9 hours. Since walk-ins were the excluded category in the logarithmic regressions predicting hiring costs, estimates of hiring cost for other recruitment sources were generated by multiplying the antilog of the appropriate coefficient times 9 hours. The table characterizes an association and should not be viewed as providing estimates of a causal model.

Recruitment sources that were significantly less costly than average were unions and relatives of current employees (Barron and Bishop 1983). The sources that were significantly more costly than average were newspaper advertising and referrals from the employment service, other government agencies, private employment agencies, schools, and other employers.

The choice of which recruitment channel to emphasize is also influenced by perceived benefits (i.e., beliefs about which channel is most likely to yield the best workers). Many employers believe that information on who made the referral and even how the applicant came to hear of the job helps in making a selection among the candidates that are interviewed (Granovetter 1974). As a result, even after an application is made, the decision to interview a particular candidate and the selection for hiring may be influenced by who referred the applicant. Interviews with employers provide evidence for the existence of these beliefs. Are these beliefs justified? That is the issue addressed in this chapter.

These beliefs were put to an empirical test by comparing individuals entering the same job at the same firm who were recruited from different sources. Four questions were asked:

- Is the time required to train a new employee associated with the source of his or her recruitment? If yes, which groups require less training?
- Is the reported productivity of a new employee associated with the source of his or her recruitment? If yes, which groups are more productive?
- Is the wage paid to new employees associated with the source of their recruitment? If yes, which groups get the higher wages?
- Does the firm obtain greater profits if it recruits workers from one source rather than another? In other words, is the productivity net of training, recruitment, and wage costs consistently higher for new hires obtained through certain recruitment channels? If yes, which recruitment channel seems to be most profitable?

In the section called "Theory," how such associations may develop is discussed. The specification of the proposed tests is discussed in "Empirical Specification," the collected information is discussed in "Data," and the results are presented in "Results."

2.2 Theory

The theoretical and empirical issues raised by the first three questions are quite different from the issues raised by the fourth question. "Yes" answers to the first three questions are quite consistent with a perfectly competitive labor market where all skills are general and information is available without cost to everyone. The data suggest that it is not uncommon for people in the same job with the same tenure to receive different wage rates. If the firm can offer different wage rates to different new hires, a perfectly competitive labor market is quite consistent with substantial differences in the expected productivity of the new employees hired for a specific job. If the employer's beliefs are correct about the correlation between recruitment channel and productivity of the sample of job seekers that contact the firm, this same correlation will appear when different workers hired in the same job are compared. Perfect competition implies that the more productive groups will receive higher wage rates and that the higher wage will exactly offset the higher productivity net of training and recruitment costs. If a firm has a policy of not varying the wage rates paid to people in the same job, then perfect and costless information and the lack of specific human capital imply that everyone hired by the firm has the same expected productivity net of training costs.[2]

Labor markets, however, are not perfect. Skills are often specific to particular employers and information about the competence of job applicants is incomplete and costly to obtain. In firms that pay the same wage to everyone, circumstances may therefore arise whereby employees recruited from one source (e.g., referral by another employer) are on average more productive than other employees who do the same work and were recruited from another source (e.g., the state employment service). In firms that adjust the entry wage to the perceived competence of the worker, the productivity net of wages, recruitment, and training costs may vary systematically with the recruitment source of the worker.

What kinds of market imperfections can produce variations in the profitability of new hires that are predictable according to the recruitment source of the new hire? The short answer to the question is imperfections that produce a correlation between recruitment source and the employer's monopsony power in hiring that specific individual. A union referral service is one example of a recruitment source that substantially affects the employer's monopsony power and, in fact, establishes monopoly power on the supply side of the labor market. If the employer's decision to use a union referral service is not a completely free choice (e.g., because of the threat of a strike), we would expect union referrals to be less profitable than a new hire obtained from other sources. The reason is that a union referral will expect the union wage which is typically higher than the wages paid to new hires who do not have a union card. While the union referral is probably more productive, studies have found that the wage differential for union workers is considerably greater than any productivity differential in their favor (Brow and Medoff 1978).

When a union is not present, the case for a correlation between employer monopsony power and recruitment source is somewhat more complicated. Competition forces the firm to offer each worker a compensation package that is at least equal to what the worker can obtain from other firms. A worker with characteristics that are visible to many employers and that predict higher productivity in many firms will inevitably receive higher compensation. A worker with characteristics that predict higher productivity in one specific firm but not in other firms, or with positive attributes that are visible to only one or two employers, may not receive appreciably higher compensation and thus may provide the firm an opportunity to receive a profit.

If the recruitment source that yields an applicant is correlated with that individual having a comparative advantage at the jobs in that firm, the result will be a systematic tendency for the recruitment source to relate to the profitability of a new hire. An individual may find a comparative advantage in working at particular firms for such reasons as the following:

- A job applicant may already know skills specific to the firm because of previous employment at that firm or a similar firm, or because he or she is a relative of a current employee.
- A job applicant may have a comparative advantage in learning skills that are specific to the firm because he or she knows the trainer.
- A job applicant may enjoy the job more because he or she will be working with relatives and friends and this might result in a higher propensity to stay at this firm. (The effect of recruitment mechanism on turnover is not examined in this study.) Another effect of enjoying the work more might be that the employer can pay a lower wage to the new hire.
- A job applicant may have special compatibility with other members of the work team (presumably resulting in greater productivity) because of similar ethnicity or existing friendships with current employees.

The second reason for systematic variation in the profitability of new hires would be the availability to the firm of information about applicants from a particular recruitment source that is not available to other employers contacted by the applicant. Such information allows the employer to make a more refined choice among applicants (e.g., avoiding less-productive workers and hiring more productive workers without having to pay extra). When an employer gets a referral from a current employee or another employer, the person hiring normally receives information about the job applicant that is not available to other employers. As a result, the theory predicts that these new hires will typically be more profitable than other new hires. Presumably, the state employment service and schools treat all employers equally, so one would not anticipate that hiring such referrals would offer the firm an opportunity to profit.

Why Do Firms Sometimes Use Less-Preferred Recruitment Sources?

If, as we have argued above, some recruitment sources generally yield less-profitable new hires than others, why are such recruitment sources used at all? In fact, most firms do not use referral sources that they believe provide the worst (i.e., the least profitable) job candidates. Many firms use more than one referral source, however. Why do they consider and hire job candidates from recruitment sources that tend to yield inferior workers?

An important feature of preferred recruitment sources is that the flow of job candidates from the source cannot be expanded at zero cost. The need to fill a job by a particular date and the cost of leaving a vacancy open makes it optimal to consider all people who apply regardless of their recruitment source and to make a job offer to the first job seeker that exceeds its reservation quality index. Sometimes the employer is lucky and is able to recruit from a preferred source and, thereby, have a good chance of hiring a better-than-average worker. On other occasions, either job applicants from the preferred recruitment source are not available or the trusted referral source tells the employer the applicants are not outstanding. When this happens, the employer must select the new hire from a pool of applicants obtained from less-preferred referral sources.

The phenomenon just described is illustrated by figure 2-1. The firm looks at applicants from three sources and hires the job applicants whose

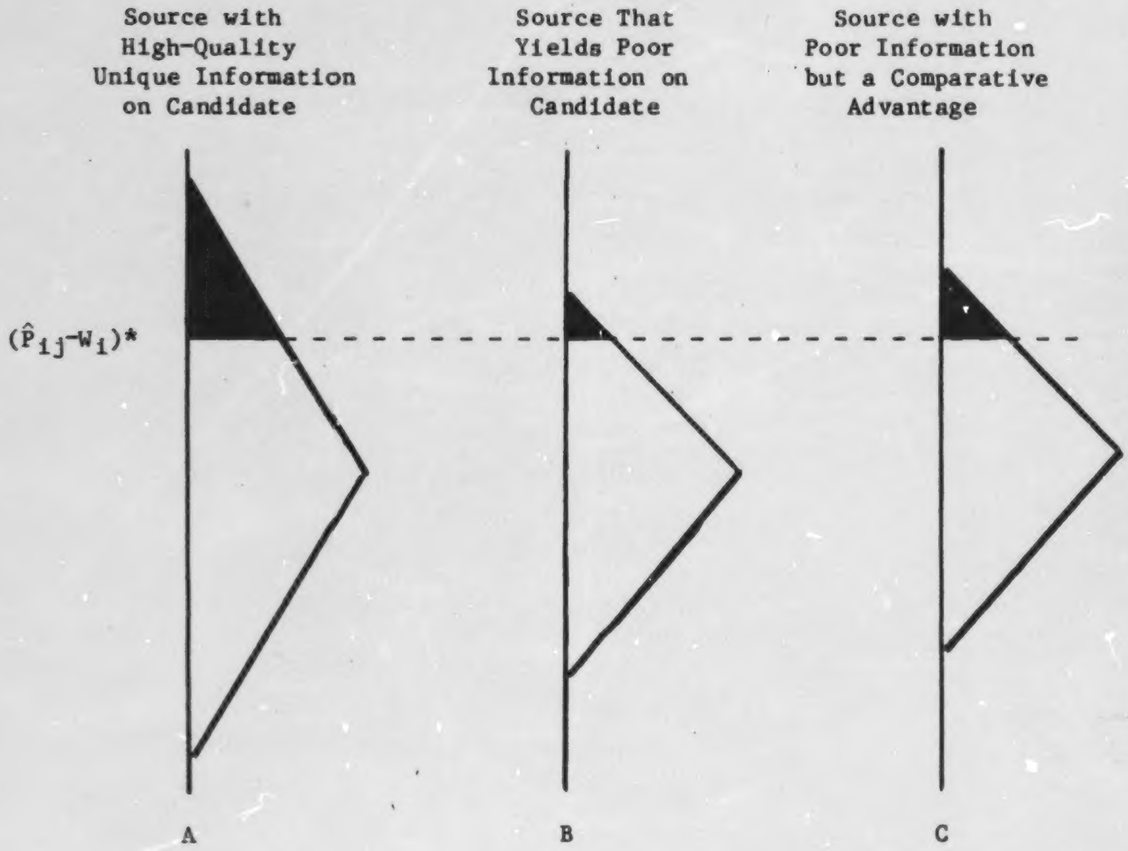

Source with High-Quality Unique Information on Candidate
Source That Yields Poor Information on Candidate
Source with Poor Information but a Comparative Advantage
$(\hat{P}_{ij}-W_i)^*$
A
B
C

Figure 2-1. Expected profitability of a new hire. The distribution of expected productivities net of the reservation wage $(\hat{P}_{ij}-W_i)$ of applicants by referral source. Note that the firm accepts applications from all three referral sources and hires everone with a $(\hat{P}_{ij}-W_i)$ greater than $(\hat{P}_{ij}-W_i)^*$ (i.e., the shaded areas). Also note that the expected profitability of those hired from referral source A (which provides unique high-quality information on the candidate) and source C (whose applicants typically have a comparative advantage) is greater than the expected profitability of those hired from source B.

expected productivity net of their reservation wage, $(P_{ij}-W_i)$, exceeds their reservation quality index. The expected profitability of the last person hired from each referral source has to be equal. Even though the means of the job applicant distributions from referral sources A and B are the same, a greater proportion of the applicants from A are hired, and for those that are hired, the mean difference between productivity and wage is larger for referral source A than referral source B. The cause of these differences is the high-quality information available on job applicants when they come from recruitment source A, which significantly increases the variance of the A distribution of expected productivities.

The other reason why one referral source may be preferred over another is illustrated by comparing B and C. The job applicants from recruitment source C have a comparative advantage regarding the firm's jobs, so distribution C has a higher mean than distribution B. This results in a higher proportion of source C referrals being hired and a higher mean net productivity from those that are hired.

A firm's ability to recruit workers through its preferred recruitment source may also vary with season or the point in the business cycle.[3] Note that if a need for a large number of new hires all at once forces the firm to lower its reservation quality index $(P_{ij}-Wj)$, the result will be an increase in the proportion of all new hires that are from B, the least-preferred recruitment source.

2.3 Empirical Specification

Predictions generated by employer conventional wisdom and the theory just outlined can be tested by estimating models that characterize how the differences in the training required, reported productivity, and wage rates of two new hires in the same job are affected by the source of recruitment of these new hires. The hypotheses generated by the anecdotal reports of employers do not imply a rejection of perfect labor markets. They relate to the impact of recruitment source on the levels of training, reported productivity, and wage rates. They are as follows:

- New hires referred by a union will receive higher wages and be more productive and less costly to train.

- New hires obtained from an expensive referral source (i.e., private employment agencies) either will be more productive and less costly to train or will be paid lower wages.
- New hires obtained from government agencies and schools will be less productive and more costly to train.
- New hires who are referred by a current employee or who are friends or relatives of a current employee will be more productive and less costly to train.

The predictions made by the theory which do imply rejection of perfect labor markets relate to the profitability of a new hire (the difference between productivity net of training cost and the wage). They are as follows:

- Union referrals will be less profitable.
- Employer referrals will be more profitable.
- Referrals by current employees of their friends and relatives will be more profitable.
- Employment agency referrals will seem more profitable (because recruitment costs are not part of the dependent variable).
- Referrals by a government agency will be less profitable.
- Referrals by schools will be less profitable.

Testing these hypotheses involves measuring the association between recruitment source and job performance in a sample of new hires. There is no need for structural models of the underlying population relationship between a worker's productivity and his/her referral source. Since an individual job seeker may appear to one employer as coming from one referral source and to another employer as coming from another referral source, such a relationship is not even well defined. Structural models of the relation between referral source and performance in a sample of job applicants cannot be estimated in data on new hires without bias because of the truncated nature of the sample (i.e., the job applicants who were believed to have low productivity were not hired, so observations on their job performance are not available) (Brown 1982). The point of the theoretical discussion is not just that some recruitment sources typically yield better workers than others, but rather that, given these associations and the selection mechanisms at work in the labor market, significant associations may continue to exist between these recruitment sources and job performance even when the job, the employer, and the wage rates are all held constant.

Let us assume that in a sample of people who have been recently hired, job performance, Y_{ij}, depends upon worker characteristics, X_{ij}, and job characteristics, Z_j. A linear model is specified then as follows:

$$(1) \quad Y_{ij} = BX_{ij} + \theta Z_j + u_{ij} + v_j$$

where

Y_{ij} is a vector of outcomes such as training time, supervisor reports of a worker's productivity, or wage rate of employee "i" in job "j";

X_{ij} is a vector of background characteristics including recruitment source of employee "i" in job "j";

Z_j is a vector of measurable characteristics of the job including characteristics of the employer;

u_{ij} is a random error that is specific to the individual; and

v_j is a job-specific or employer respondent-specific error.

A problem arises in estimation of equation (1). Because the wage rate and the amount of training received depend upon unmeasured characteristics of the job that are correlated with characteristics of the occupant of the job, the covariance of X_{ij} and v_j is almost certainly nonzero. So, biased estimates of coefficient vector B will be produced. This problem can be dealt with by estimating a fixed effects model in which the differences in the outcomes experienced by two people in the same job at the same firm are modeled as a function of differences in their background characteristics, as is shown in equation (2):

$$(2) \quad Y_{1j} - Y_{2j} = B(X_{1j}-X_{2j}) + u_{1j} - u_{2j}$$

where person one and two both work in the same job "j." Estimating (2) produces unbiased estimates of B if the X_{ij}'s are not correlated with the u_{ij}'s.

2.4 Data

An employer survey sponsored by the National Institute of Education and the National Center for Research in Vocational Education conducted between February and June 1982 provides the data necessary for examining the association between referral source of a new hire and that new hire's reported productivity and required training time. The survey represented the second wave of a two-wave longitudinal survey of employers from selected geographic areas across the country. The first wave, not utilized in this study, was funded by the U.S. Department of labor to collect data on area labor market effects of its Employment Opportunity Pilot Project (EOPP). The survey encompassed 10 EOPP pilot sites and 18 comparison sites selected for their similarity to the pilot sites. The survey design specified a strategy of over-sampling firms with a relatively high proportion of low wage workers. The second wave made an attempt to interview all of the respondents in the first wave survey. About 70 percent of the original respondents completed surveys for the second wave. The data collected by this second wave survey on the circumstances surrounding a recently hired worker are more extensive than those available in the first wave, or in any other data set known to the authors.

In the bulk of the sample the respondent was the owner/manager of the establishment. In large organizations, the primary respondent was the person in charge of hiring, generally the personnel officer. When the primary respondent was unable to answer a question, he was asked if someone else in the organization would have the information and that part of the interview was completed with this other official. Other respondents were: controllers, wage and salary administrators, and line supervisors (for questions about a particular recent hire). A copy of the questionnaire as well as other related information is available on request from the authors.

The sample of jobs for which paired data are available was generated in the following manner. A stratified random sample of 3,712 employers was interviewed. Three hundred of these did not have the time for a long interview, so shortened questionnaires were administered. Employers who received the full questionnaire were asked to select "the last new employee your company hired prior to August 1981, regardless of whether that person is still employed by your company." A total of 818 employers could not provide information for a recent new hire. Most of these firms were small organizations that had not hired anyone in recent memory. The employers that provided information on one new hire were asked to provide data on a second new hire in the same job, but with contrasting amounts of vocational education. Of the 2,594 employers that provided data on one new hire, 1,511 had not hired anyone else in that job in the last 2 years, and 424 had not hired anyone with a different amount of vocational training for that position in the last 2 years. As a result, data are available on 659 pairs of individuals who have the same job at the same establishment. Missing data on specific questions used in the model further reduced the sample used for estimation to about 450. Most of the establishments from which paired data are available are small.[4] Seventy percent have fewer than 50 employees and only 12 percent have more than 200.

Data on the amount of time that is devoted to training new employees during their first 3 months was obtained from the employer (or immediate supervisor in large firms). Separate questions asked about training hours spent in formal training, informal training by management, informal training by co-workers, and watching others do the job (see questions 206, 271-280 in appendix B).[5] For the sample of firms and jobs, the means for the typical worker were as follows:

- Watching others do the job--47.3 hours
- Formal training programs--10.7 hours
- Informal training by management--51.0 hours
- Informal training by co-workers--24.2 hours

A training time index was constructed that valued and then combined the time invested in the latter 3 types of training activities during the worker's first 3 months on the job.[6] When supervisors and co-workers are giving informal training to a new employee, the trainee is almost invariably directly involved in a production activity. Employers report that for informal training, the trainees are typically as productive while being trained as they are when working alone. Consequently, informal training is assumed to involve only the investment of the trainer's time.[7] The arithmetic mean of this index is 124 hours, implying that the value of the time invested in training a typical new employee in the first 3 months is about 23 percent of the output that a co-worker would produce in 3 months. The first row of tables 2-3 and 2-4 reports the effects of recruitment source on the logarithim of this training time index.

The impact of referral source on the success of a new hire will also be assessed by examining its association with the reported productivity of the new worker.[8] The questions asked for a supervisor's report of the productivity of new employees (see questions 282 and 283 in appendix B) after 2 weeks, 12 weeks, and at the time of the survey. The mean values of these indexes of reported productivity were as follows:

- The first 2 weeks--49.0
- The next 10 weeks--64.6
- Current or most recent--81.4

If it is assumed that these productivity indexes are proportional transformations of true productivity plus a random error, it is possible to combine the estimates of time investments in training with these productivity estimates to produce estimates of productivity net of training costs of each new hire during the first 3 months of employment.[9] The formula for this calculation is given by--

$$(3) \quad NP_i = RP_i \left(1 - \frac{TW_i + TF_i}{520} \right) - \frac{CT_i + 1.5 * MTI_i}{520} + MTF_i$$

where

NP_i = productivity net of training cost of new hire "i",

RP_i = relative productivity of new hire to productivity of typical worker with 2 years' tenure,

$$= \frac{.167\ PROD2_i + .833\ PROD312_i}{PRODTYP},$$

$PROD2_i$ = reported productivity of new hire during the first 2 weeks,

$PROD312_i$ = reported productivity of new hire over the next ten weeks,

PRODTYP = reported productivity of typical worker in same job with 2 years of tenure,

TW_i = time watching others over first 3 months,

TF_i = time spent in formal training over first 3 months,

CT_i = co-worker time spent training new hire informally over first 3 months,

$MTI_i, (MTF_i)$ = management time spent training new hires informally (formally) over first 3 months.

Productivity net of training cost is defined relative to the productivity of a worker with 2 years of tenure. Its mean is 0.48.

Another dependent variable in the analysis is wage rate. Questions were asked about the recent hire's current and starting hourly wage rates and an average rate paid to workers with 2 years of experience. If the respondent could not report hourly rates, he or she was asked what the monthly salary was and how many hours the individual worked per week. An hourly wage was calculated by dividing the salary by 4.33 times hours worked per week. Note that the starting rate is a nominal wage and that consequently the time since the person was hired must be controlled when the starting wage is a dependent variable.

The final dependent variable studied is a measure of the worker's productivity net of training cost minus the wage during the first 3 months of employment as follows:

$$(4) \quad \text{Employer net benefit}_{(i)} = \begin{array}{l}\text{Productivity}\\ \text{net of train-}\\ \text{ing cost}_{(i)}\end{array} - \left(\frac{\text{Starting wage}}{\begin{array}{l}\text{Wage at 2 year}\\ \text{tenure (typical)}\end{array}}\right)_{(i)}$$

The wage term is normalized on the wage of a typical worker with 2 years of tenure, whereas the training cost term has been normalized on the reported productivity of a worker with 2 years of tenure. Subtracting one from the other means we are assuming that by the end of the second year of employment, a typical new worker's productivity rises to the point where it equals the wage rate being received for the work. The difference between employer net benefits received from two different workers was regressed on differences in their background characteristics and recruitment source. The results of this regression are presented in the bottom rows of tables 2-3 and 2-4. Most of the theory discussed in this chapter relates to this variable. The employer net benefits, or profitability of hiring the "i"th worker, is a measure of $a_i + a_{ij} - w_i$ for the first 3 months of employment.

2.5 Results

The models that were estimated distinguish the effects of 11 different potential recruitment sources: (1) union, (2) employer, (3) friend of owner or current employee, (4) relative of owner or current employee, (5) newspaper, (6) employment agency referral, (7) school referral, (8) government agency,

TABLE 2-3

ASSOCIATION BETWEEN REFERRAL SOURCE AND THE TRAINING REQUIRED; REPORTED PRODUCTIVITY AND WAGE RATE OF A PARTICULAR WORKER
(FROM MODEL THAT EXCLUDES OTHER CREDENTIALS)
(PERCENTAGE DIFFERENCES FROM A WALK IN)

	Union	Employer	Don't Know	Friend	Relative	Other Referral	Newspaper	Employment Agency Referral	School Referral	Government Agency Referral	R^2
Total Training Time	-45.0** (1.9)	-14.9* (1.6)	-39.8*** (3.3)	- 4.9 (.9)	- 2.8 (.4)	2.8 (.3)	- 7.5 (1.0)	- 4.8 (.4)	4.2 (.5)	4.7 (.5)	.057
Reported Productivity											
First 2 weeks	+65.3*** (2.7)	3.3 (.4)	8.7 (.7)	4.7 (1.1)	.8 (.1)	7.0 (.9)	- 2.0 (.3)	4.8 (.5)	- 1.7 (.3)	- 8.8 (1.2)	.085
3rd-12th week	24.3* (1.3)	9.4* (1.6)	9.3 (1.0)	4.0 (1.2)	1.8 (.4)	2.9 (.5)	.4 (.1)	- 5.9 (.8)	.6 (.1)	- 5.4 (1.0)	.063
Current or most recent	29.9* (1.6)	5.5 (.9)	3.8 (.4)	4.1 (1.3)	- 2.3 (.5)	4.7 (.9)	.3 (.1)	7.2 (.9)	3.8 (.8)	- 3.7 (.6)	.106
Productivity Net of Training Cost	56.2 (1.3)	24.1** (1.7)	49.7** (2.3)	5.3 (.7)	6.4 (.6)	6.8 (.5)	4.9 (.5)	1.9 (.1)	- 8.2 (.7)	-19.2* (1.4)	.062
Wage Rates											
Starting	59.5*** (4.8)	2.5 (.8)	10.5** (2.1)	.3 (.2)	- 6.3*** (2.6)	.1 (.0)	- 1.2 (.5)	1.4 (.3)	- 3.0 (1.2)	.2 (.1)	.171
Current	26.8** (2.1)	7.5** (2.1)	13.0** (2.2)	1.8 (.9)	- 4.0 (1.4)	2.7 (.7)	- .9 (.3)	3.0 (.6)	- 1.3 (.4)	- 3.1 (.9)	.201
Employer Net Benefits (First Quarter)	-52.7 (1.2)	18.8 (1.4)	32.9* (1.6)	4.6 (.6)	7.3 (.7)	5.3 (.4)	4.5 (.4)	- 7.3 (.4)	- 4.2 (.5)	-22.2** (1.7)	.055

Note: These estimates of equation 5 include controls for the following variables--knew when hired worker was eligible for subsidy, hours worked per week, whether job was originally temporary, whether worker is a student. Models predicting current reported productivity and wage rates contain additional controls for tenure and tenure squared. Models predicting starting wage rates and employer net benefits contain years since hired and years since hired squared. T-statistics are in parentheses under the coefficient.

*$p < .10$ on a one-tail test
**$p < .05$ on a one-tail test
***$p < .01$ on a one-tail test

TABLE 2-4

ASSOCIATION BETWEEN REFERRAL SOURCE AND THE TRAINING REQUIRED; REPORTED PRODUCTIVITY AND WAGE RATE OF A PARTICULAR WORKER
(FROM MODEL CONTAINING OTHER CREDENTIALS)
(PERCENTAGE DIFFERENCES FROM A WALK IN)

	Union	Employer	Don't Know	Friend	Relative	Other Referral	Newspaper	Employment Agency Referral	School Referral	Government Agency Referral	R^2
Total Training Time	-35.5*	-12.6*	-30.1	- 4.2	- 3.5	8.8	- 5.4	2.1	4.0	1.7	.259
	(1.6)	(1.5)	(2.6)	(.8)	(.5)	(.9)	(.8)	(.2)	(.5)	(.2)	
Reported Productivity											
First 2 weeks	+54.9***	1.2	.7	4.7	1.8	.6	- 3.7	- 1.2	- 7.1	- 7.1	.208
	(2.4)	(.2)	(.1)	(1.2)	(.3)	(.1)	(.6)	(.1)	(1.1)	(1.0)	
3rd-12th Week	16.7	8.0*	3.6	4.0*	2.3	- .3	- .3	-10.2	- 1.2	- 4.0	.158
	(1.0)	(1.4)	(.4)	(1.3)	(.5)	(.1)	(.1)	(1.2)	(.3)	(.7)	
Current or most recent	21.0	3.9	.2	4.4*	- 2.3	2.2	- .5	4.9	2.6	- 2.9	.162
	(1.2)	(.7)	(.1)	(1.4)	(.5)	(.4)	(.1)	(.6)	(.5)	(.5)	
Productivity Net of Training Cost	35.8	20.2	31.7	4.8	- 5.0	- 2.7	2.0	- 8.3	-12.9	-15.4	.209
	(.9)	(1.5)	(1.6)	(.7)	(.5)	(.2)	(.2)	(.5)	(1.1)	(1.2)	
Wage Rates: Starting	51.7***	2.4	4.3**	.3	- 5.2***	- 2.2	- 2.0	- .6	- 4.0	.1	.171
	(4.9)	(.9)	(1.0)	(.2)	(2.5)	(.8)	(.9)	(.2)	(1.7)	(.1)	
Current	19.4**	6.8**	8.8*	1.7	- 3.1	.3	- 1.9	- .8	- 2.8	- 3.4	.314
	(1.7)	(1.9)	(1.6)	(1.0)	(1.2)	(.1)	(.7)	(.2)	(.9)	(1.1)	
Employer Net Benefits (First Quarter)	-61.9*	14.8	23.8	4.4	5.2	.4	3.3	-11.0	- 7.5	-18.1*	.122
	(1.5)	(1.1)	(1.2)	(.6)	(.5)	(.0)	(.3)	(.6)	(.6)	(1.4)	

Note: These estimates of equation 5 include controls for the following variables--age, age squared, education, female, relevant experience, relevant experience squared, knew when hired worker was eligible for subsidy, hours worked per week, whether job was originally temporary, relevant vocational education, whether worker is a student. Models predicting current reported productivity, and wage rates contain additional controls for tenure and tenure squared. Models predicting starting wage rates and employer net benefits contain years since hired and years since hired squared. T-statistics are in parentheses under the coefficient.

*$p<.10$ on a one-tail test
**$p<.05$ on a one-tail test
***$p<.01$ on a one-tail test

(9) walk-in, (10) other, and (11) "don't know." Walk-in is the excluded category, so the coefficients presented in tables 2-3, 2-4 and 2-5 are estimates of the effect of the named recruitment source in comparison to the effect of the new hire being a walk-in.

Estimates of equation 2, predicting differences between two specific individuals in the same job, are presented in tables 2-3 and 2-4. All models presented have controls for the following characteristics of the job/worker match: (1) hours worked per week, (2) a dummy equal to 1.0 when the job was supposed to be temporary, (3) a dummy equal to 1.0 when the employee was eligible for subsidy and this was known by the employer when the hiring decision was made, and (4) a dummy equal to 1.0 when the employee was going to school part-time while working.

In models of current or most recently reported productivity and wage rates, using specification one, the differences between person one and person two's tenure and tenure squared are both included as controls. The number of months since the hiring and its square (differenced) are entered in the models of starting wage rates and net benefits for employers. Table 2-3 reports the results for models that do not contain controls for other credentials and table 2-4 presents results obtained when controls were included for the following background characteristics of the new hire: (1) vocational education, (2) previous relevant work experience, (3) experience squared, (4) age, (5) age squared, (6) education, and (7) sex.

The first thing to examine in tables 2-3 and 2-4 is the R^2 presented in a column on the far right-hand side. The R^2s for models of differences between 2 different occupants of the same job range from 0.162 for current productivity to 0.314 for current wage rates when other credentials are in the model, and from 0.055 to 0.201 when other credentials are not included in the model. For cross-sectional models of differences between two people, these R^2s are remarkably high.

When the background characteristics of the new hire are controlled (as in the models presented in table 2-4), coefficients reported reflect the effect of referral source on various measures of the success of the match between employer and employee, net of the effects of such worker credentials as age, relevant experience, sex, education, and vocational education. The theory explaining how the employer's monopsony power in certain recruitment channels results in it being more profitable to hire from certain referral sources relates to the *gross association* between recruitment source and indicators of the success of the match. Thus, the discussion that follows will focus on the results of models without controls for other credentials (table 2-3). When other credentials are excluded from the model, coefficients on the recruitment source variables are generally slightly larger and more statistically significant. However, none of our main results would change if we were instead to focus on models that did contain controls for other credentials. Since the hypothesis tests are directional for all referral sources except "don't know," "other," and newspapers, the test statistics reported in this chapter are for one-tail tests unless otherwise stated.

2.5.1 Union Referral

A union referral was the recruitment source used only about 1 percent of the time. The effects of a union referral are reported in the first column of tables 2-3 and 2-4. The coefficients on the union referral dummy with no controls for credentials imply that referrals by a union take 45 percent less time to train, are 65 percent more productive in the first 2 weeks, are 24 percent more productive in the next 10 weeks, and are 30 percent more productive at the time of the interview. Despite the very small number of cases where only 1 of 2 new hires at a firm was referred by a union, the coefficients are significant at 0.03 level on a one-tail test in the training time regression, significant at the 0.01 level in the regression predicting productivity in the first 2 weeks and significant at the 0.054 level in the current productivity regression.

Union referrals receive 60 percent higher starting wage rates and 27 percent higher current wage rates. These differentials are significant at the 0.0001 and 0.02 level, respectively. The effect of union referral on the profitability of the new hire, (e.g., productivity, net of training costs, and wages) is given in the bottom row. Hiring a union referral rather than a walk-in lowers the profitability of the hire during the first 3 months by 53 percent of the mean productivity net of training costs of new workers. Despite the large size of the effect, it is statistically significant only at the 0.108 level.

2.5.2 Employer Referrals

About 6 percent of the new hires were referrals from other employers. Employer referrals have 15 percent lower training time (P = 0.053), 9 percent higher productivity during the 3rd through 12th week (P = 0.053), and 24 percent higher productivity net of training costs (P = 0.045). Starting wage rates are slightly and nonsignificantly higher. Employer net benefits during the first 3 months are larger by an amount equal to 18.8 percent of the net productivity of a typical new hire (p = 0.085). The employer does not, however, seem to receive any long-term benefit from hiring an employer referral, because wage rates at the time of the interview are 7.5 percent higher (p = 0.02). An after-the-fact explanation of the delayed rise in wages may be the need to forestall a rehire of the worker by the employer who provided the referral.

2.5.3 Friends and Relatives of Current Employees

About 30 percent of the new hires were friends of either the owner or a current employee. Coefficients on the dummies for hiring a friend had the hypothesized signs, but were significant in only a few cases. Training time was a nonsignificant 5 percent lower, and reported productivity was 4 percent higher during the 3rd through 12th weeks of employment (P = 0.105), and 4.1 percent higher at the time of the interview (P = 0.102). Friends of current employees do not receive higher starting wages. A direct test of whether employers benefit during the first 3 months from hiring a friend of a current employee, rather than a walk-in, found no statistically significant difference.

About 10.6 percent of the new hires were relatives of either the owner or a current employee. Relatives were reported to be slightly though generally nonsignificantly more productive. Surprisingly, relatives received (in model 1) 6.3 percent lower starting wages (P = 0.009 on a two-tail test). The point estimate for the effect of hiring a relative rather than a walk-in on productivity net of training costs and wages in the first 3 months is 7.3 percent of the net productivity of a new hire. The effect is not statistically significant, however. The point estimate of the effect of hiring a friend, 4.6 percent, was quite similar. If effects of this nature last for only 3 months, they are worth the modest sum of $105 and $125.

Whether or not the hypothesized effects of referral source last beyond the first 3 months is, therefore, of great interest. A lower bound net benefit proxy can be constructed for the date of the interview by subtracting wage differentials from productivity differentials. Since this omits training time effects (which were not measured beyond the first 3 months), it understates the continuing impact of recruitment source and other variables on the profitability of particular new hires. The point estimates for this measure of the current effects of recruitment source are almost 0 (1.8 percent) for relatives, but are a rather substantial 3.6 percent ($P = 0.14$) for friends. If this was to continue as long as the workers stayed at the firm, the present discounted value (at 33 percent to capture the effects of turnover) of the additional profit from hiring a friend of the owner or an employee rather than a walk-in is $2,182. Substantively, this would be quite an important effect. The relevant coefficient is not statistically significant, however, so some uncertainty remains about the long-run effect of hiring friends.

2.5.4 Don't Know and Other Referrals

Employers responded that they did not know the source of about 2 percent of their new hire and that a referral source other than the ones listed was used in about 4 percent of the cases. There was no hypothesis specified about how or whether these new hires would be different from walk-ins. "Other referrals" were not different from walk-in's in any consistent or significant way. The training time, productivity net of training cost and wage rates of "Don't knows" were significantly different (using two-tail tests of significance) from those of a walk-in. No explanation of this finding has occured to the author.

2.5.5 Newspaper Ads

Advertising in a newspaper is a rather inexpensive way of attracting a lot of job applicants. About 12 percent of the new hires were recruited through a newspaper ad. The firm has no special access to information on the applicant, so there does not appear to be any reason to expect new hires recruited through newspapers to be different from walk-ins. None of the effects of recruiting through a newspaper ad are statistically significant, and coefficients have no consistent pattern.

2.5.6 Private Employment Agency Referrals

About 2.7 percent of the new hires were referrals from private employment agencies. Since private employment agencies generally charge employers quite a substantial fee, their referrals were expected to be more productive, require less training time, and be paid lower wages. None of these hypotheses can be accepted. Point estimates imply effects in the opposite direction: training time is greater and productivity is lower. The data seem to imply that, unless the use of private employment agencies saves the firm a great deal of screening and hiring costs, they are a bad deal for the firm. An hypothesis that employment agency referrals are sufficiently more productive to warrant a fee of 20 percent of wages is rejected for productivity net of training cost and for employer net benefit. Many private employment agencies specialize in occupations that are in shortage. Their seemingly poor performance may reflect a tendency for employers to ask for agency referrals only when other recruitment methods have failed to yield a qualified candidate.[10]

2.5.7 Referrals by Schools

About 3.7 percent of the new hires were referred by a school. It was hypothesized that school referrals would require extra training, be less productive, and be less profitable for the firm. The signs of the coefficients are consistent with the hypothesis in 9 out of 12 cases. However, but none of the coefficients are statistically significant. Productivity net of training costs of school referrals during the first 3 months is lower by 8.2 percent ($P = 0.25$). Starting wage rates are 3.0 to 4.0 percent lower ($P = 0.089$ on a two-tail test) when other credentials are controlled. As a result, employer net benefits are a nonsignificant 4.2 percent lower. While the point estimates are consistent with our hypothesis, the effects are small if they are there at all, and much larger samples would be required to obtain a powerful test of the hypothesis.

2.5.8 Referrals by Government Agencies

Referrals by the employment service, CETA, a welfare agency or a community based organization like the Urban League accounted for 4.2 percent of the new hires in the sample. The hypothesis that these referrals require extra training and are less productive and less profitable employees was supported by the data. The signs of all 12 coefficients are consistent with the hypothesis. Productivity net of training costs of government agency referrals is 19.2 percent lower (P = 0.077). The regressions also imply that the net benefits of hiring a government referral are lower by a statistically significant 22.2 percent (P = 0.042) of a new worker's net output. If controls for the workers' credentials are included in the model, the effect is an 18 percent reduction (P = 0.075) on the net benefit of a new hire.

2.6 Summary and Caveats

In this section we summarize the main findings and point out the limitations of the study and suggest avenues for future research. A theoretical model has been developed of how recruitment source influences the profitability--worker output minus training costs and wages paid--of a new hire. The theory implies that, since competition forces all firms to pay wages roughly equal to the market's assessment of a worker's generalized productivity, a firm can profit from hiring a worker only if (1) it has information about the worker not available to other employers that implies the worker is better than the market seems to indicate, or (2) the worker has a comparative advantage in working at that firm. The following specific hypotheses were derived from this general proposition:

- Employer referrals and new hires who are friends or relatives of the boss or a current employee will require less training, and be more productive and more profitable than walk-ins.
- Employment service and school referrals will require more training, and be less productive and less profitable than walk-ins.
- Because of the high fees, referrals from private employment agencies will require less training and be more productive and seem more profitable than walk-ins.
- Union referrals will be paid more, will be more productive, but will be less profitable to the firm.

The hypotheses regarding the effect of private employment agencies were decisively rejected in every case. The remaining hypotheses specified the sign of 38 regression coefficients in each of 2 specifications. If controls for credentials are not included in the model (table 2.3), only 4 coefficients have the wrong sign and 12 of the 38 coefficients are statistically significant at the 10 percent level or better. If controls for other credentials are included (table 2.4) only 3 coefficients had the wrong sign and 10 of the 38 coefficients were significant at the 10 percent level or better. Except for predictions about the effects of private employment agencies, these results appear to provide reasonably strong support for the theory and the resulting hypotheses that were developed.

A number of caveats are in order, however. The theory related to the determinants of the present discounted value of the profit--difference between productivity net of training costs and wage rates--of hiring workers from different recruitment sources. Most of the data analyzed, however, related to only the first 3 months of employment. Data limitations make it difficult to address whether the effects documented for the first 3 months of employment continue indefinitely. The present discounted value of the benefits of hiring from a particular recruitment source depend critically upon whether the effects uncovered for the first 3 months continue into the second, third, and fourth years of tenure. This gap in the analysis needs to be filled by studies that measure training costs beyond the first 3 months of employment.

Reductions in turnover are another potential benefit of giving preference to certain recruitment sources. Research into the association between turnover and recruitment source is underway and preliminary results suggest that referrals from informal sources--friends and relatives of current employees--have considerably lower rates of turnover. These results provide additional support for our theory.

The patterns reported here could be the consequence of offering workers from different recruitment sources different implicit contracts (relating to the time pattern of the connection between productivity and wage rates), or from a general tendency to reward even predictable variations in productivity, after the fact, through promotions and wage increases. These possibilities cannot be ruled out until evidence has been obtained on the longer-run associations between turnover, productivity net of training and wages, and recruitment source.

Another area needing more research is the validity and scaling of the indexes of reported productivity. The current project has examined the association between the recruitment source through which a new employee was hired and the employers' report of the productivity, the training requirements, and wage rates of that new employee. Little is known about the scaling and validity of these reports. Since wage rates move with reported productivity, the calculations of net benefit are sensitive to the paper's assumption that reported productivity is a proportional transformation of true productivity plus a random error. Research needs to be directed at validating these indexes and replicating these findings in other data sets.

FOOTNOTES

1. Even when no announcements are made, no ads are placed, and no referrals are requested, having a vacancy seems to increase the number of phone contacts by job seekers by about 10 percent and increase personal visits by about 20 percent. This suggests that knowledge of the existence of a vacancy gets informally transmitted to some job seekers even when the firm has made no effort to publicize it.

2. This occurs despite the fact that some categories of job applicants (e.g., those referred by a current employee or another employer) may have a higher average productivity level than others. Each firm evaluates its job applicants and offers a job only to those whose expected productivity exceeds a cutoff point. Firms will be more likely to make job offers to applicants with characteristics (e.g., previous work experience or a strong recommendation from someone the employer trusts) associated with a high productivity level. Workers whose expected productivity is substantially above a firm's cutoff point know that other firms offering better jobs will recognize their productive potential and, therefore, choose not to apply at this firm or choose to turn down this firm's job offer. Workers with expected productivity that is below this firm's cutoff point either do not apply (because they know they are not qualified for the job) or are not offered a job when they do apply. These workers must settle for jobs at firms that offer somewhat less-attractive positions.

3. When the economy is at the bottom of a recession, firms are typically able to hire workers with greater-than-average levels of expected productivity. At the peak of the cycle, when labor markets are tight, the employers are typically forced to hire workers who have less training and experience, who come from less-preferred referral sources, and who are less productive. The result is that some of a firm's employees (those hired during a recession) are simultaneously more productive and better credentialed (i.e., have greater training and experience) than other employees. Thus, seasonal and cyclic variations in the tightness of labor markets can produce a within-firm correlation between productivity and referral source, even if all new hires at any given point in time were to have identical expected productivity.

4. Note that the sample is representative of the hiring experiences of a group of employers, not the hiring experiences associated with the employment of a group of job seekers during a specified time frame. The sample most likely underrepresents larger employers if the employment of a group of job seekers over a specified period of time were to be considered.

5. In a few cases employers reported that more than 520 hours (13 weeks times 40 hours a week) had been devoted to a specific training activity during the first 3 months on the job. While the new hire might have received training from more than one supervisor, it is unlikely that two trainers were simultaneously in one-on-one contact with the new hire. Consequently, the computer

edit of this data changed all reports of more than 520 hours involved in a training activity to 520.

6. Our respondents reported that during the first three months on the job that new employees were about 80 percent as productive as workers with two years of tenure in the job. Consequently, the trainees' time was valued as equal to 0.8 hour of coworker training time. The management staff members who provide formal and informal training were assumed to be paid 1.5 times the wage of coworkers. Formal training involves both the trainer and trainee's time. Sometimes it is one on one and sometimes it is done in groups. It was assumed that the average ratio of trainees to trainers was 2 and that the value of the trainer's time (including materials cost of training was twice the wage of a coworker with two years of tenure. The training index is thus equal to 1.8 times the hours in formal training plus 1.5 times the hours in training by management plus hours in training by coworkers. The results are not sensitive to the details of the assumptions made to create this index.

7. Time watching others was not included in the index because no data was obtained on how it varied across individuals in the same job. The index was constructed under an assumption that the four training activities were mutually exclusive. This implies that, if the sum of the hours devoted to individual activities is greater than 520, that a reporting error has occurred which overstates investment in training. In the few cases where the sum of hours devoted to training exceeded 520, the training time index was adjusted downward by the ratio of 520 to the sum of the hours reported for individual activities. This procedure reduces the mean of the index by about 10 percent. It was also assumed that a reporting error had occurred if absolutely no training of any kind was reported. In those very few cases 4 hours of training was assumed instead.

8. The interview questions about the productivity of recently hired employees were intended to provide indicators of the relative productivity of one worker at different points in time or two different workers in the identical job. They do not attempt to measure productivity in any absolute sense and, therefore, are not comparable across firms. Many of the uses made of these data only require that the index be correlated with true productivity. Estimates of the magnitude of training investments that combine time inputs of other staff with the lower productivity of the trainee require an assumption that the index is cardinal and a proportional transformation of true productivity plus a random error. The questions asking for a rating of the productivity of particular workers have remarkably low-nonresponse rates. Only 4.4 percent of respondents asked about a particular new hire's productivity during the first 2 weeks responded with a "don't know" or refused to answer. Comparably defined nonresponse rates for other questions were 8.2 percent for previous relevant experience, 3.2 percent for age, 6.7 percent for education, 8.6 percent for time spent in informal training by supervisor, and 5.7 percent for a three-question sequence from which starting wage rate is calculated. The low-nonresponse rate implies that our respondents felt that they were capable of making such judgments and augur well for the quality of the data that results.

9. If employer reports of a worker's productivity are equal to an unknown constant times the worker's true marginal product plus a random error, percentage differences in cell means of the productivity index can be interpreted as unbiased estimators of percentage differences in true productivity. If the variations in the productivity scores assigned by supervisors exaggerates the proportionate variations in the true productivity, our estimates of percentage impacts of recruitment source on productivity will be biased upward. Even though it is possible for a worker's true productivity to be negative, the scale was defined as having a lower limit of zero. Floors and ceilings on a scale typically cause measurement errors to be negatively correlated with the true value. If this were the case, the result would be an understatement of the percentage impacts of recruitment source on the productivity, net productivity, and profitability of a new hire. In our view, this latter type of bias is more likely than the former. Until the productivity indexes are validated, this view must remain unsupported by any evidence.

10. Intensive interviews at one firm, which uses private employment agencies to recruit and screen computer programmers, suggests an explanation for the use of private employment agencies. The firm was large enough to have a personnel office but did not hire programmers frequently enough to warrant having a specialist in the personnel office with the expertise necessary to recruit and screen computer programmers. The only people in the firm who had the necessary expertise were the staff of the firm's Computer Services Division. The fees of private employment agencies were paid out of the Personnel Department's budget. Since another department's budget incurred the expense of contracting out the recruitment and screening function and his own staff would have had to do most of the work if the function had been retained in the firm, the director of the Computer Services Division had very little incentive to choose a direct applicant over an equally qualified agency referral, or to attract additional direct applicants by advertising in the paper or pursuing informal contacts at computer science departments.

CHAPTER 3

WHY DO EMPLOYERS UNDERINVEST IN ON-THE-JOB TRAINING?

John Bishop and Suk Kang

3.1 Introduction

Every year employers and employees jointly invest a massive amount of resources in on-the-job training (OJT). Despite its importance, however, very little is known about it's magnitude, its distribution and its effects. The absence of data containing direct measurement of the time devoted to OJT and the productivity of individual workers that receive OJT has forced economists to treat both OJT and its primary outcome, greater productivity, as unobservables. Training has had to be proxied by imperfect indicators such as tenure on the job and experience, and the only outcomes that could be studied were earnings and turnover.

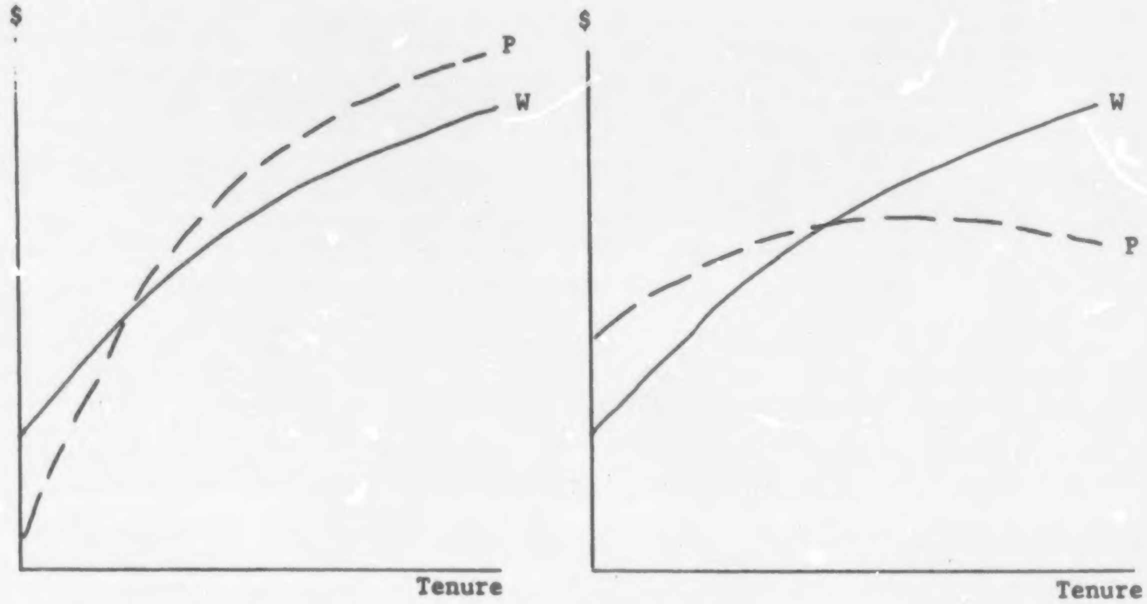
The unsatisfactory nature of the empirical work in this area is accentuated by the variety and richness of the theoretical developments. The theory of on-the-job training accepted by most economists starts with the observation that training develops two distinct types of skills: general and specific. Specific training raises the worker's productivity in the organization providing the training, but this training cannot be applied in other organizations. The outcome of specific training might include such things as: learning how to operate a particular piece of machinery in a way that avoids breakdowns, knowing where to find things in the plant, learning whom to ask for advice about particular matters, or learning how to communicate best with one's supervisors. General training raises a worker's ability to be productive in other organizations as well as the one providing the training. General training includes activities such as learning how to operate or repair a type of machine used by many organizations, learning how to read a blueprint, or developing good work habits that are important for success in any job--punctuality, reliability, self-discipline, and ability to work as a team member.

As workers receiving general training become more productive, the firm will raise their wages to keep them. Since the workers get the benefits of the training, not the firm, a firm will not be willing to pay any of the costs of general training. Thus, the competitive firm that provides only general training will offer, during the training period, a wage equal to the value of the marginal product of the worker minus the cost of the training. Some workers will volunteer to work during training at this wage, even if it is below what could be earned elsewhere without the training, because it will mean a higher wage later. The wage paid the worker will at all times equal that workers productivity net of training cost. This pattern is graphed in figure 3-2.

The theory predicts that the costs and the benefits of specific training are shared by the employees and their employer. Workers who receive specific training will not be offered comparable wages by other firms because the productivity of that worker will be higher in the firm in which specific training is received than in another firm. Therefore, firms offering this type of training can recover part of the training cost by offering trained workers a posttraining salary, lower than their marginal product in that firm, but higher than their (current or future) marginal product elsewhere. The employer's contribution to the cost of specific training is the difference during training between the wage paid and the workers productivity minus the cost of training. The employees' contribution to the costs of general and specific training is the difference between their wages during training and the wages they could obtain in jobs that offer no training opportunities.

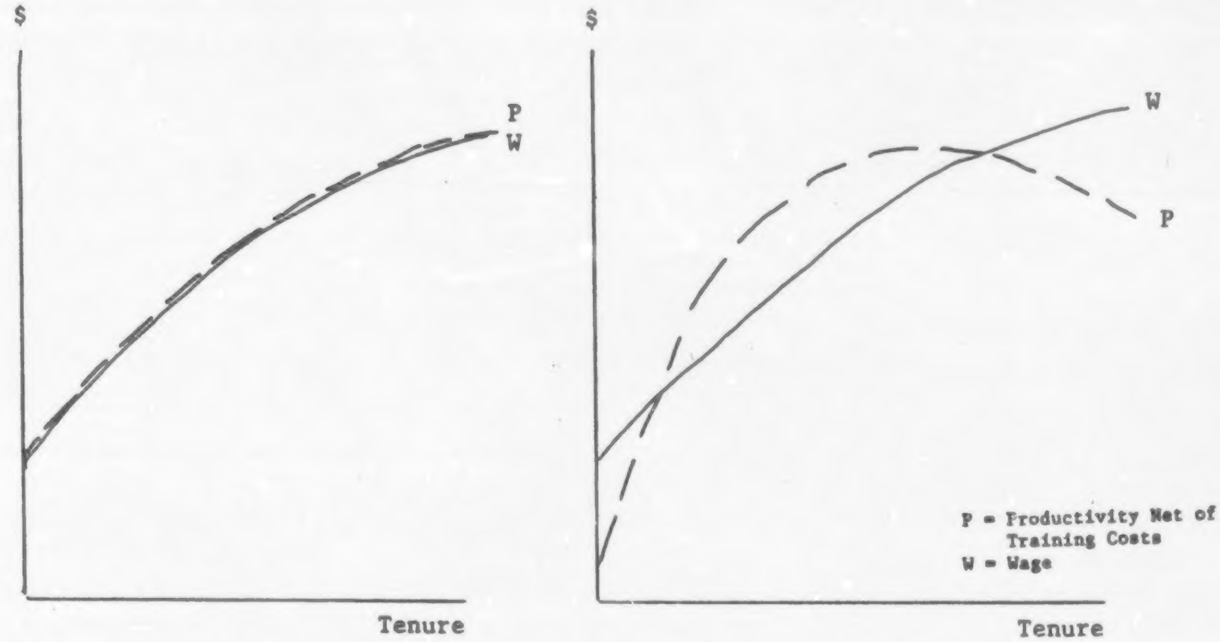
Hashimoto (1981) and Hashimoto and Yu (1980) have shown that sharing the costs and benefits of a specific human capital investment occurs only when postinvestment compensation is prespecified. In his model the share of specific human capital investment that is paid for by the worker, and, therefore, the rate of wage growth (for any given level of training), is negatively related to the responsiveness of the quit rate to the differential between in-firm and out-of-firm wage rates, positively related to the responsiveness of the dismissal rate to the firm's second period wage. Performance measures that are accurate and acceptable to workers also raise the share of the specific human capital investment that are paid by the worker. Since some of the skills learned in a new job are inevitably specific to the firm, the theories of on-the-job training proposed by Becker and Hashimoto imply that productivity net of training costs will rise more rapidly than wage rates during the training period. This growth pattern is graphed in figure 3-1.

The message of most of the other recent theoretical papers on the time pattern of wage rates is quite different. The models that have been developed all seem to imply that the rate of increase of wage rates will equal or exceed the rate of increase of productivity net of training costs. Salop and Salop (1976) and Nickell (1976) have shown that if investments in specific human



3.1 Front load compensation (Specific Human Capital)

3.3 Back loaded compensation (Lazear's Agency Theory Medoff and Abraham)



3.2 No load compensation (General Human Capital Salop and Salop)

3.3 Front and back loaded compensation (Bishop and Kang combined with Medoff and Abraham)

Figures 3-1 through 3-4. The time pattern of compensation and productivity net of training costs: alternative views.

capital make turnover costly and workers have information not available to firms on how likely they are to quit, some employers will attempt to attract those with low quit probabilities by imposing a hiring fee (through a below market starting wage) and raising the wage level in subsequent periods. The equilibrium wage pattern results in the worker paying all the training costs and receiving all the benefits of investments in specific human capital, and in the wage rates rising in step with rises in productivity net of training costs (see figure 3-2).

Jovanovic (1979) has developed a job-matching theory of turnover which hypothesizes that workers remain in jobs in which their productivity is high and are fired (or quit) from jobs in which their productivity is low. His model predicts that the wage rate for workers with a particular amount of tenure is equal to the expected marginal products for workers of the tenure class and that, therefore, sorting out the least productive gradually raises the productivity of the group and therefore the wage rate. This wage pattern is also characterized by Figure 3.2.

Lazear (1981) shows that the need to provide incentives for greater effort and the lags in recognizing and rewarding effort result in a wage structure that pays less than marginal product net of training costs early in a worker's tenure at a firm and more than the worker's marginal product toward the end of the worker's tenure as in figure 3-3. Lazear and Moore (1981) tested this model by comparing the wage profiles of self-employed individuals to the wage profiles of wage and salary employees. Upon finding flatter wage profiles for the self-employed they concluded that "under some strong assumptions, our conclusion . . . is that most of the slope of the age earnings profile reflects incentive based wealth and not human capital accumulation via on-the-job training" (p. 19.). We do not view this test as definitive, however, because flows in and out of self-employment makes it difficult to construct a longitudinal wage profile from cross-sectional data, because self-employed individuals may for some reason invest less in OJT, and because Cohn and Kiker (1983) obtain the opposite result using similar methodology.

All of these theories--OJT, self-selection, Lazear's principal agent theory, and Jovanovic's sorting theory--predict that wages will rise with tenure and experience. Consequently, the fact that wages do indeed rise with tenure and experience carries no implication about which theory is best. Truly powerful tests of these competing theories require direct measurement of crucial theoretical constructs that typically have been treated as unobservables in empirical work (e.g., the amount of training received, whether that training is general or specific, and the productivity of the worker). Medoff and Abraham (1981) were the first to collect the data necessary to test the on-the-job training theory of wage profiles with tenure and experience. Using microdata from the personnel records of four large U.S. corporations, Medoff and Abraham found that, within a grade level, there is simultaneously a positive association between wage rate and experience and there is a negative association between performance rating and experience. They concluded that, "under the assumption that rated performance is a valid indicator of relative productivity, our results imply that a substantial fraction of the return to experience among the groups we are studying is unrelated to productivity" (p. 187). Medoff and Abraham also reviewed a large number of other studies and concluded that the association between seniority in a job and productivity is curvilinear. During the initial very short orientation/training period there is a positive association. Once this training period is over, however, there tends to be a negative association between tenure and productivity amongst those who occupy a particular job (i.e., have not been promoted to greater responsibility). This implies growth patterns either like figure 3-3 or 3-4. Almost all the studies were conducted in large corporations and almost all of the workers included in these studies had many years of tenure at the firm. These findings tend to support the proposition that one and possibly more of the non-OJT explanations of wage growth are substantively important partial explanations of the rise of wage rates with tenure after the initial 1-3 year adjustment/learning period is completed.

Medoff and Abraham's findings do admit to another explanation, however. The data available to Medoff and Abraham provided measures of productivity and wage rates. The theories being tested, however, specify a relationship between productivity net of training costs and compensation, the sum of wages and fringe benefits. The least tenured workers in a particular employment grade are likely to be those who are receiving rapid promotions. The past and anticipated future job changes of these workers mean they are more likely to receive more intensive training than the older, more tenured workers in that employment grade. This means that even though productivity may be *negatively* correlated with tenure within an employment grade, productivity net of training costs (production minus the value of the time that others spend training the individual) may be *positively* correlated with tenure within employment grade.

The other possible hole in the Medoff and Abraham argument is that workers with vested pension rights and many years of tenure may find that the present value of their pension benefits is declining as they postpone retirement. If this were the case, total real compensation of workers who are not being promoted as they approach retirement might be falling. On this point there is controversy. Lazear's (1981) study of defined benefit pension plans found that the present discounted value of expected pension receipts tend to decline with additional years of tenure once the individual has more than 20 years of tenure and is over age 55. Kotlikoff and Wise (1983), however, do not find declines in pension wealth as retirement is postponed beyond the age of early retirement. The different results are a consequence of different assumptions about interest and inflation rates and a different sample of plans.

The only other study to examine the issue of relative rates of growth of productivity and wage rates is that of Bishop (1982). Using data from the first wave of the Employment Opportunity Pilot Project (EOPP) employer survey, he found that employers report significant investments in training (a total of 34 hours of supervisor and co-worker time in the first month) and significant improvements in the reported productivity of new employees in the first year or two on the job. Furthermore, the amount of training offered on a job has a statistically significant effect on both reported productivity growth and wage growth.[1] These results provide strong support for the proposition that during the first year or two on a job, on- the-job training is a major contributor to a worker's improved productivity and rising wages. These results do not, however, imply that other forces such as self selection or sorting are not contributing to the tendency of wage rates to rise with tenure. In fact, the data support the substantive importance of sorting as a contributor to wage and productivity growth with tenure. Also, they may not be inconsistent with Medoff and Abraham's findings since they relate to only the first year on a job and are for a sample of establishments whose size (the geometric mean is 16 employees) is considerably below that of the firms studied by Medoff and Abraham.

The purpose of this study is to generalize the theory of on-the-job training to include sorting phenomena and to test the predictions of the theory regarding the relative growth rates of wages and productivity net of training costs early in a worker's tenure against the predictions of principal agent theory and of models in which self-selection is based on propensities to quit. One of the important overall implications of the theory discussed next is that because of the specificity of the match and differential access to loans at low rates of interest the rate of wage growth will typically be below the rate of growth of productivity net of training costs early in the worker's tenure (i.e., wage and productivity growth follows the pattern graphed in figure 3-1 or 3-4).

The format for the remainder of the chapter is as follows. "Data" describes the data set used to test the predictions of the theory. Competing theories are then tested in "Results" by constructing estimates of the growth rates of wages and productivity net of training costs and tabulating by the degree of generality of the training. These tests provide support for the theory developed earlier in the chapter. "Are Private Decisions about On-the-job Training Socially Optimal?" explores the reasons for discrepancies between social and private rates of return to on-the-job training and develops the policy implications of the research.

3.2 Theory

(A nontechnical summary of the Theory's predictions appears at the end of this section.)

Model with Stochastic Quits and Dismissal

The firm's training level and wage profile will be analyzed in a simple two period model. Training is assumed to produce two types of skills: general skills (g) that are useful at other firms and specific skills (h) that are productive only at the firm providing training. The cost of the training C(g,h) is incurred in the first period and the benefits are received in the second period.

There are two random elements in the model. The first element is the wage offer that competing employers make to the worker at the beginning of the second period; the second element is the worker's productivity during the second period in the firm after the training is completed. It is assumed that wages and productivities in the two periods are as follows:

	Worker's Productivity	Wage Offer
First period at the firm	P	w^1
Second period at the firm	$P+g+h+\varepsilon_0$	w^2
Second period at other firms		$w^3(g)+\varepsilon$

where

P	is the worker's productivity without training,
g	is the increment in productivity due to general training,
h	is the increment in productivity at the firm due to specific training,
ε_0	is the random factor in productivity in this firm which capture the quality of the match at the training firm,
w^1, w^2	are first and second period wages at the firm,
$w^3(g)+\varepsilon$	is the wage offer from other employers which depends on the amount of general skill and the random factor which measures the quality of the firm-worker match at the alternative firm.

At the end of the first period the worker will quit if the alternative wage ($w^3(g)+\varepsilon$) exceeds the firm's second period wage (w^2). The worker, not the employer, learns about ε at the end of the first period.

The firm providing the training knows the worker's productivity in this firm ($P+g+h+\varepsilon_0$) by the end of the first period. If the worker's productivity is less than the second period wage, the firm will dismiss the worker. The random factor ε_0 is a measure of the quality of the firm-worker match at the current firm.

There are four possible combinations of worker-firm decisions at the end of first period.

Worker	Firm	Result
Stay	Keep	Retention
Stay	Dismiss	Separation
Quit	Keep	Separation
Quit	Dismiss	Separation

At the beginning of the first period neither the worker nor the firm know the worker's exact productivity in this firm and in other firms. The firm offers a wage package, (w^1, w^2), that is, based on the prior knowledge of the worker's productivity and the nature of uncertainties involved (i.e., p.d.f. of ε_o and ε). In the first period, the firm invests in the training of the worker, taking into account the possible loss due to separation in the following period. Training investment takes two forms: investment in firm-specific skills and general skills. General training increases the wage that the worker can obtain in alternative employment as well as his or her productivity in this firm, while specific training does not affect his productivity outside the firm. Workers accept the job offer from this firm if the wage package and training plan are generous enough to attract workers in a competitive labor market. In their decision, workers take into account the possible gains or losses from a voluntary or involuntary separation. It is assumed that the worker and the firm have the same prior distributions on the uncertainties surrounding the worker's productivity in this firm and worker's income opportunity outside the firm in the second period. Further, it is assumed that both firm and worker are neutral risk. At the end of the first period, the worker learns what wage he or she can get in the second period at other firms. This real wage is affected by the amount of general training perceived by other employers and the cost involved in making the transition. If the wage offer from the other firm (net of transition cost) is higher than the firm's wage (w^2), the worker will quit. By the end of the first period, the firm knows the worker's productivity in the second period.

The firm's objective is to maximize the discounted sum of profit from two periods by choosing wage rates in two periods, w^1 and w^2, and an amount of general training, g, and specific training, h, subject to the constraint that the wage offer and the amount of training are generous enough to attract new hires in a competitive labor market. The firm's expected profit maximization problem when ε and ε_o are independent is written as--

$$(1) \quad \underset{g,\, h,\, w^1,\, w^2}{\text{Max}} \; P - C(g,h) - w^1 + D_a[\Pr(S)\,\Pr(K)(P+g+h+E(\varepsilon_o|K))-w^2]$$

Subject to the constraint

$$(2) \quad R \leq w^1 + D_b[\Pr(S)\Pr(K)w^2 + (1-\Pr(K))w^3 + (1-\Pr(S))\Pr(K)(w^2+E(\varepsilon|Q))]$$

where

$E(\varepsilon_o|K)$ is the expected value of ε_o given that the firm wishes to keep the worker,

$E(\varepsilon|Q)$ is the conditional expectation of ε given that the worker quits the firm,

D_a and D_b are the discount factor of the firm and worker, respectively

$Pr(S)$ is the prior probability the worker is willing to stay with the firm,

$Pr(K)$ is the prior probability the firm is willing to keep the worker,

R is the level of expected utility the worker can attain in the competitive labor market.

The probability of a worker wishing to stay in the firm, $Pr(S)$, is

$$(3)\quad \begin{aligned} Pr(S) &= Pr(w^3(g)+\varepsilon \gtrsim w^2) = Pr(\varepsilon \gtrsim w^2-w^3(g)) \\ &= 1-\Phi(w^2-w^3(g)) \end{aligned}$$

where

Φ is the cumulative density function (c.d.f.) of ε.

Also, $Pr(K)$ is written as--

$$(4)\quad \begin{aligned} Pr(K) &= Pr(P+g+h+\varepsilon_o \gtrsim w^2) \\ &= Pr(\varepsilon_o \gtrsim w^2-P-g-h) \\ &= 1-\Phi_o(w^2-P-g-h) \end{aligned}$$

where

Φ_o is the c.d.f. of ε_o.

Denoting the probability density function (p.d.f.) of Φ and Φ_o by ϕ and ϕ_o, the first order condition for the second period wage is written as--

$$(5)\quad 0 = D_a[\phi\cdot Pr(K)D_k - Pr(S)Pr(K)] + D_b[Pr(S)Pr(K) - \phi_o G_k]$$

where

D_k and G_k are defined as

$D_k = P+g+h+E(\varepsilon_o|K)-w^2 > 0,$

$G_k = Pr(S)w^2+(1-Pr(S))(w^3+E(\varepsilon|Q))-w^3 > 0.$

D_k is the firm's expected profit on workers who want to stay and it wants to keep. Alternatively, it may be intrepreted as the quasi-rent the firm receives in the second period on the workers they keep.

G_k is the gain the worker receives from not being dismissed. G_k can be interpreted as the expected wage if kept, $Pr(S)w^2+(1-Pr(S))(w^3+E(\varepsilon|Q))$, minus the expected wage if dismissed, w^3, or alternatively the quasi-rent received by workers who are kept in the second period.

The first order conditions for general and specific training (g and h) are given by (6) and (7).

$$(6)\quad C_g = D_a[Pr(S)Pr(K) - \phi w_g^3 Pr(K)D_k] + D_b[(1-Pr(K)Pr(S))w_g^3 + \phi_o G_k]$$

where

$$C_g = \partial C/\partial g,\ w_g^3 = \partial w^3/\partial g,$$

$$(7)\quad C_h = D_a \cdot Pr(S)Pr(K) + D_b \phi_o Gk$$

where

$$C_h = \partial c/\partial h.$$

Also the optimal wage in the first period, w^1, is determined so that the constraint (3) is binding.

$$(8)\quad R = w^1 + D_b[Pr(S)Pr(K)w^2 + (1-Pr(K))w^3 + (1-Pr(S)Pr(K)(w^3+E(\varepsilon|Q))]$$

The first order conditions--(5), (6), (7), and (8)--characterize the optimal wage and training package the firm will offer. In what follows, the economic implications of these conditions are examined.

Choosing the Wage Structure

The understanding of what determines w^2 will be aided by specifying the income opportunity outside the firm, $w^3(g) + \varepsilon$, in more detail. We write $w^3(g)$ in the following form:

$$(9)\quad w^3(g) = P + \hat{g} - T$$

where P is the productivity of a worker who does not recieve general training in the first period, g is the increment of the wage offer due to general training, and T is the transition cost. Employers use the interview and the reputation of the previous employer to predict the true value of the general training. The estimate by other employers of the productivity gain due to the original firm's general training is $\hat{g}$.

Other potential employers cannot observe the exact amount of human capital that is produced by the training.[2] The signal that provides information on the level of training contains a good deal of noise. Denoting the signal other employers receive by $\tilde{g}$, the following relation is assumed:

$g = \tilde{g} + v$, v is a noise independent of g.

Other firms predict the true level of general skill using the prior expectation of g and the signal $\tilde{g}$. When the prior distributions of g and v are normal the posterior expectation of g is

$$\hat{g} = E(g|J) + b(\tilde{g}-E(g|J)) = E(g|J) + b[g-E(g|J)] + bv$$

where $E(g|J)$ is the other firm's prior expectation of general human capital of the particular class of job seekers, given information set J. J represents the worker's characteristics visible to the prospective employer, such as, occupation, industry, and firm size of previous job and background characteristics of the individual, and b is given by

$$b = \frac{var(g|J)}{var(g|J)+var(v)} < 1$$

where $var(g|J)$ is the conditional variance of g given J (Leamer, 1978, pp. 51-55). This implies that a unit increase of general skill results in less than proportional increases in other firms' wage offers.

Substituting (9) into the first order condition for w^2, and after rearranging terms, the optimum wage rate in the second period is written as follows:

$$(10)\quad w^2 = [P+h+g+E(\varepsilon_o|K)] - \frac{\theta}{1+\theta}[T+E(\varepsilon_o|K) + (h+g-\hat{g}) - E(\varepsilon|S)] - \frac{(D_a-D_b)}{D_a}\frac{Pr(S)}{(1+\theta)\phi}$$

where

$$\theta = \frac{D_b}{D_a} \cdot \frac{\phi_o}{\phi}\frac{Pr(S)}{Pr(K)}$$

and $E(\varepsilon|S)$ is the conditional expectation of ε given the worker wishes to stay in the firm.

Equation (10) implies that the expected profit from the worker staying with the firm is positive. Since in the long-run equilibrium, competition among firms brings the expected profit of the firm to zero, the wage rate in the first period must be higher than the worker's productivity net of training cost by a compensating amount. Thus our model predicts that in the early stage of employment, productivity net of training cost grows faster than wage rate. The firm's net profit is negative in the investment period, but the loss is compensated for in the second period when the firm receives the return from human capital investment.

The wage offer in the second period is the expected productivity of the worker, $P+g+h+E(\varepsilon_o|X)$, less the second and third terms in (10). The second term indicates that given the value of θ, the factors that reduce the firm's second period wage offer (and also raise the firm's first period wage offer). are--

- transition cost, (T);
- difference between a worker's true general human capital (g) and other employer's perception of his general human capital g. This could be positive or negative depending upon whether the firm provides more or less general training than is average for that occupation and industry; and
- average unattractiveness of alternative employment to the worker who wants to stay, $(-E(\varepsilon|S))$.

The expression in brackets is the difference (for those workers who are kept and want to stay) between the worker's productivity in the firm, $P+\hat{g}+h+E(\varepsilon_o|K)$, and the worker's income on his or her next best alternative, $P+g-T+E(\varepsilon|S)$.

Anything that raises productivity in the firm but does not raise it outside the firm, will raise the second period wage at the firm. The wage increase is smaller than the rise in productivity so the firm's profit on the worker in the second period goes up. The two factors that will produce this effect are--

- specific human capital, (h); and
- expected gain from having the option of dismissing less productive workers, $(E(\varepsilon_o|K))$

Also, other things being equal, the second period wage offer declines if $\theta/1+\theta$ is large. A factor that makes $\theta/(1+\theta)$ large is--

- the second period wage has a larger proportionate impact on the probability the employer will keep the trained worker than it has on the probability the worker will want to stay.

The third term of (10) reflects the fact that the model is characterizing wage and training contracts at firms that face an infinitely elastic supply of new hires but a less than infinitely elastic supply of trained labor. New hires take second period wages into account when evaluating the firm's job offer. Consequently, the decline in the elasticity of labor supply with the worker's tenure influences the wage structure only when the firm and its workers have different rates of time preference. Workers typically have higher rates of time preference (i.e., lower discount factors) than firms. Subsidized student loans are not available for financing investments in on-the-job training. Without collateral, banks will not lend money for this purpose. Even with collateral, the loan will be at an interest rate that exceeds the interest rates charged businesses by a considerable amount. In addition workers are more likely than firms to face a higher marginal tax rate in the second period than in the first period. These two factors result in firms being more willing than workers to trade off future earnings for present earnings. The compensation packages that result reflect the worker's preference for compensation now rather than later. Thus, the third term of (10) implies that the firm's second period wage offer will be reduced and the first period wage increased to the extent that--

- The firm's discount factor is larger than the worker's discount factor, $D_a-D_b>0$, and
- the proportionate response of the proportion staying ($\phi/Pr(S)$) to the firm's second period wage is small (e.g., the labor supply elasticites of trained workers are low).

Choosing the Level of Training

The f.o.c. for specific capital, (7), says that the marginal cost of investment in specific capital is equated to the marginal discounted revenue to the firm--the discount factor times the retention rate times one dollar ($D_aPr(S)Pr(K)$) plus the discounted marginal benefit to the worker of the specific training. Benefit of specific training to the worker is captured by the second term of (7). The increased productivity makes the firm less likely to dismiss the worker. This effect is captured by ϕ_o. In (7), ϕ_o is multiplied by G_k--the benefit the worker receives from not being dismissed.

The first order condition for general training, (6), characterizes the optimal amount of general training. The marginal cost of general training is equated to the discounted marginal revenue to the firm plus the discounted marginal benefit to the worker. The marginal revenue to the firm from general training has two elements. The first element is the marginal product of a dollar of expenditure on general training for the workers who are going to stay with the firm ($Pr(S)Pr(K)$). The second element measures the loss the firm is likely to experience because, with given w^2, quit rates will rise.

The higher level of general skill implies better alternative income opportunities for the worker. For a given second period wage, quits will rise by ϕw_g^3. Per quit, the loss the firm experiences is $Pr(K)D_k$--the probability the firm wants to keep the worker times the quasi-rent received by the firm from those workers it keeps.

The marginal benefit of general training to the worker also has two elements. The first element is that, if the worker is leaving the firm (voluntarily or involuntarily), general training increases the wage offer in other employment. The second element reflects the fact that the increased productivity makes the firm less likely to dismiss the worker. This benefits the worker, and the amount of the benefit is G_k. The worker benefit of reduced risks of dismissal roughly offsets the loss the employer experiences from the quits that are induced by the rise in other firms' wage offers.[3]

Substituting the first order conditions for w^2 and $b = w_g^3$ and rearranging terms, the condition describing the equilibrium level of general human capital is this:

$$(11) \quad C_g = D_a Pr(S)Pr(K)(1-b) + D_b b + D_b(1-b)\phi_o G_k.$$

If other firms fully perceive the quality of training provided by the firm ($b=1$), the condition reduces to setting the marginal cost of training (C_g) equal to D_b, the worker's discount factor. If other firms cannot perceive differentials in training quality ($b = 0$), the condition becomes identical to that for specific human capital.

The inability of other firms to perceive all of the firm-to-firm variations in the amount of general human capital has the effect of dividing the marginal returns to general human capital into two parts. The share of the total return that the worker is assured of getting, whether or not he or she stays at the firm (b), is discounted by the worker's rate of time preference. The share that is perceived only by the firm that provides the training (1-b) is depreciated by the retention rate and discounted by the employer's internal rate of return. Equation (11) implies that investment in general OJT increases with the firm's and the worker's discount factor (D_a and D_b) and the retention rate, and decreases with its marginal cost. Because turnover rates of new hires are rather high, we expect that $D_a Pr(S)Pr(K) + D_b \phi_o G_k < D_b$.[4] If so, an increase in the quality of the signals available to other firms will increase investment in general OJT.

Nontechnical Summary

The theory of the determinants of on-the-job training and the time pattern of compensation makes the following assumptions about the environment:

- OJT develops two distinct types of skills, general and specific which are produced jointly.
- The training firm can accurately measure the amount of general training received by its worker, but other firms cannot.
- Workers are not able to borrow money at as attractive rates of interest as their employers, (consequently, they make choices between alternative job opportunities placing a very high value on receiving compensation now rather than later).
- The compensation offered by a firm has a bigger effect on job seeker's decisions to take a job than on whether to quit a job at a later time.

When these assumptions about the environment in which training and compensation are determined are combined with a model of a competitive labor market, we get the following predictions about the time pattern of compensation.

- Employers bid for new employees by offering front loaded compensation packages. (Compensation packages like those depicted in 3-1 or 3-4.) Since most workers have a stronger desire to have a dollar now rather than later than their employer, the firm in effect uses its borrowing power to offer new employees a wage package which pays in advance of performance. Moving allowances are a clear example of this phenomenon but the same thing is also accomplished by offering higher starting wages and raising wages with tenure by less than the rise in productivity net of training costs. The tendency of firms to front load compensation is greatest when quit rates are not very responsive to the second period wage and when there is a big difference between the worker's and the employers ability to borrow.

- Compensation tends to be front loaded if the people who stay at a firm tend to find that the attractiveness of alternative jobs falls with tenure on the current job. The factors that have this effect are costs of job search or job changing, an underestimate by other employers of the amount of general training received, and the tendency of those with better alternatives or the greatest dissatisfaction with their current job to leave and of those with less attractive alternatives and greater satisfaction with their current job to stay.

- Front loading of compensation is greater when the second period wage has a greater proportionate impact on the probability an employer will keep a worker than it has on the probability the worker will want to stay (i.e., choose not to quit).

- Anything that raises productivity in the firm but does not raise it outside the firm will raise the wage in the second period but not by as much as productivity at the firm increases. Two factors that will produce this effect are training that is specific to the needs of the employer (and not useful to other employers) and the ability of the firm to fire the least productive employees. Here again the result is a front loaded wage package.

- General training which raises productivity equally both in and out of the firm results in wages rising along with the rise in productivity net of training costs as in figure 3-2. Post-training wage rates will have to be higher and starting wage rates will consequently be lower.

The Consequences of a Front Loaded Compensation Package

A front loaded compensation package means that at first the firm is investing more in training and in learning about the new employee's productivity. Later in the worker's tenure these investment pay off and the employee's output exceeds the wages paid. If the worker quits before the return from the investment is recouped, the employer loses money on the hire. As a result, employers offering front loaded compensation packages will tend to give hiring priority to job applicants who are not likely to quit. An employer whose wage structure closely tracks the average increase in the productivity of new employees will tend to give hiring priority to job applicants who look like fast learners. While front loaded compensation causes the firm to try to select employees who will not quit, it tends to increase the propensity of those it does hire to quit. It is not clear whether the result will be higher or lower quit rates. Which of these two influences is more powerful depends on which of the factors mentioned is causing the compensation package to be front loaded.

The theory predicts that even when training is entirely general most compensation packages will be front loaded during the first couple of years on the job or in other words that wage rates will rise more slowly than productivity net of training costs.

The Training Decision

The theory also makes some important predictions about the determinants of investment in on-the-job training:

- Firms and workers will invest more in general and/or specific OJT when interest rates are low, when tax rates on the returns to the investments are low, when separation rates are low, when other employers recognize the value of improvements in the quality of a firms training and when costs of training investment are deductable in the year incurred and the tax rates during the year of the investment are high.
- Decisions about the provision of specific human capital depend upon the tax rates faced by the firm and the interest rate the firm must pay to borrow money. The fact that the costs and benefits of specific human capital investments are shared does not mean that decision making about the amount of specific training is shared. The interest rate the employee must pay to borrow money and his tax situation does not affect the decision.
- When general OJT is perceived accurately by all potential employers, the worker must finance all its costs and it is the interest rates and tax rates faced by the worker that determines whether the investment is undertaken. The impact of these factors on the level of general training is similar to their impact on a young person's decision to remain in school. The primary difference is that generous low interest loans are not available to finance employer-provided general training as they are for attending institutions of postsecondary education.
- When the quality of general OJT provided by an employer is not accurately perceived by other potential employers, the costs and benefits of the training are shared between employer and employee. Decision making authority over its level is also shared. The level of investment is influenced by the rates of interest and taxation faced by both the employer and the employee.

3.3 Data

An employer survey sponsored by the National Institute of Education and the National Center for Research in Vocational Education conducted between February and June 1982 provides the basis for analyzing the size and character of on-the-job training and testing the theory developed in part two. The survey represented the second wave of a two-wave longitudinal survey of employers from selected geographic areas across the country. The first wave, not utilized in this study, was funded by the U.S. Department of Labor to collect data on area labor market effects of its Employment Opportunity Pilot Project (EOPP). The survey encompassed 10 EOPP pilot sites and 18 comparison sites selected for their similarity to the pilot site. The survey design specified a strategy of oversampling firms with a relatively high proportion of low wage workers. The second wave made an attempt to interview all of the respondents is the first wave survey. About 70 percent of the original respondents completed surveys for the second wave. The data collected by this second wave survey on the circumstances surrounding a recently hired worker are more extensive than those available in the first wave, or in any other data set known to the authors.

In the bulk of the sample the respondent was the owner/manager of the establishment. In large organizations, the primary respondent was the person in charge of hiring, generally the personnel officer. When the primary respondent was unable to answer a question, he or she was asked if someone else in the organization would have the information and that part of the interview was completed with this other official. Other respondents were: controllers, wage and salary administrators, and line supervisors (for questions about a particular recent hire). A copy of the questionnaire as well as other related information is available on request from the authors. Each employer surveyed was asked about the training provided to the last employee hired prior to August 1981. A total of 447 employers responded that they had hired a new employee but did not have complete information on the hiring and training process, and, therefore, did not complete this part of the interview. The 2,264 employers who provided answers to a series of questions concerning the last person hired make up the sample of employers whose hiring activity is to be examined.[5]

Questions were asked about the recent hire's current and starting hourly wage rates and an average rate paid to workers with 2 years of experience. If the respondent could not report hourly rates, he or she was asked what the monthly salary was and how many hours the individual worked per week; an hourly wage was calculated by dividing the salary by number of hours worked per month (4.33 times the hours worked per week). Since the starting rate reported in the interview is a nominal wage, its level will depend on the general wage level at the time the individual was first hired. Consequently, when the starting wage is a dependent variable, the time since the person was hired must be controlled.

Data were obtained on the amount of time that is devoted to training new employees during their first 3 months. Separate questions were asked about training hours spent in formal training, informal training by management, informal training by co-workers, and watching others do the job (see questions

206, 271-280 in appendix C).[6] For the sample of firms and jobs, the means for the typical worker were as follows:

- Watching others do the job--47.3 hours
- Formal training programs--10.7 hours
- Informal training by management--51.0 hours
- Informal training by co-workers--24.2 hours

A training time index was constructed that valued and then combined the time invested in training activities during the first 3 months on the job. The management staff members who provided formal and informal training were assumed to be paid 1.5 times the wage of a co-worker and the trainee's time was valued as equal to 0.8 hour of co-worker training time. When supervisors and co-workers are giving informal training to a new employee, the trainee is almost invariably involved directly in a production activity. Employers report that for informal training, the trainees are typically as productive while being trained as they are when working alone. Consequently, informal training is assumed to involve only the investment of the trainer's time. The training time index is equal to 0.8 times the hours spent watching others do the job plus 1.8 times the hours in formal[7] training plus 1.5 times the hours in training by management plus hours in training by co-workers.[8] The arithmetic mean of this index is 124 hours, implying that the value of the time invested in training a typical new employee in the first 3 months is about 23 percent of the output that a co-worker would produce in 3 months.

The survey asked the employer (or in larger firms the immediate supervisor) to report on the productivity of the typical individual hired in the job (see questions 282 and 283 in appendix A) after 2 weeks, 12 weeks, andat the end of 2 years at the firm.[9] The mean values of these indexes of reported productivity were as follows:

- First 2 weeks--49.0
- Next 10 weeks--64.6
- After 2 years--81.4

In most of the work to follow, it is assumed that these productivity indexes are proportional transformations of true productivity plus a random error.[10] This makes it possible to combine the estimates of time investments in training with these productivity estimates to produce estimates of productivity net of training costs of each new hire during the first 3 months of employment. The assumption that these productivity indexes are a proportional transformation of true productivity plus a random error is, of course, arbitrary. Sensitivity to the main findings concerning this assumption will be tested by presenting estimates of total training costs that are based on 3 alternative assumptions: proportionate differences in productivity are in fact 150 percent of those reported, 50 percent of those reported and nonexistent. The general formula for these calculations is--

$$\text{NP} = \frac{\text{RP}\cdot\text{TP}}{520} - \frac{\text{CT} + 1.5*\text{MTI} + \text{MTF}}{520} \tag{12}$$

where

NP = productivity net of training cost of typical new hire

RP = relative productivity of new hire to productivity of typical worker with two years' tenure

$$= \frac{.167\ \text{PROD2}_i + .833\ \text{PROD312}_i}{\text{PRODTYP}}$$

TP = time attempting to produce. The conservative calculation of training costs assumes TP = 520. Calculations using liberal assumptions assumes TP = 520 - TW - TF.

PROD2 = reported productivity of typical new hire during the first 2 weeks

PROD312 = reported productivity of typical hire during the next 10 weeks

PRODTYP = reported productivity of typical worker in same job with 2 years' tenure

TW = time watching others over first 3 months

TF = time spent in formal training over first 3 months

CT = co-worker time spent training new hire informally over first 3 months

TI,(MTF) = management time spent training new hires informally (formally) over first 3 months.

3.4 Results

The theory developed in section 2 predicts that even when training is entirely general, wage rates will rise more slowly than productivity net of training costs. This outcome is predicted whenever workers poor access to loans at reasonable rates of interest than firms (i.e., worker's preference for a dollar now rather than 5 years from now is much greater than that of employers), and/or whenever there are other sources of specificity besides specific training such as costs of transfer or the impacts of selective retention. This prediction contrasts with the predictions of Becker's theory of general human capital, Lazear's agency model, Jovanovic's sorting model, and Salop and Salop's self selection model. These models all predict that when training is general that wage rates will rise at a rate that is above the rate of growth of productivity net of training cost. Data on training, reported productivity, and wage rates during the first 2 years of tenure on a job from a sample of 1,493 recently hired workers will be used to test these competing theories. In order to minimize problems of recall and of adjusting actual starting wage rates for inflation since the date of hire, the sample was limited to jobs of new employees who were hired after July 1, 1980 (e.g., less than 24 months prior to the interview).

Employers were asked "How many of the skills learned by new employees in this job are useful outside of this company?" Fifty-nine percent responded "almost all," 13 percent responded "most," and only 7.5 percent answered "almost none." This question provides us with an independent direct measure of the generality of the training provided by a firm. It allows us to test our hypotheses about relative rates of growth of wage rates and training in a sample of jobs that require highly general skills. The employers were next asked how many other local firms made use of the general skills that were developed in their training. This question allows a further refinement of our classification of jobs. The jobs that offer the most general skill training are defined to be those reported to have "almost all" of their skills useful at other firms and 16 or more other firms in the local labor market that in fact use these skills. Data for these jobs are presented in the first column of table 3-1. The second column presents data for the jobs where almost all of the training was useful in other firms, but here the number of such firms in the locality was small enough (below 16) to suggest that employers might have some monopsony power. The groupings for the other three columns are based only on the generality of the skills taught without regard to the size of the local market for these skills.

The first two rows of the table present mean ratios of starting to current or second year wage rates. Since the starting wage is a wage paid about a year previous to the interview, after adjusting for inflation, only 8 or 9 percent of the 16 percent increase reflects wage progression with tenure. Wage increases are similar in all of the jobs with some generality in their

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TABLE 3-1

TRAINING, WAGES, AND PRODUCTIVITY OF TYPICAL NEW EMPLOYEES BY GENERALITY OF SKILLS TAUGHT

	Number of Skills Useful Outside This Company				
	Almost All				
	GT 16 other firms	LT 16 other firms	Most	Some	Almost None
Wage Rates					
Ratio starting/2 years (typical)	.86	.85	.83	.83	.93
Ratio starting/current (actual)	.88	.89	.88	.88	.90
Hours Spent in Specific Training Activities in First 3 Months					
Watching others do the job	49.0	50.9	48.1	46.3	27.6
Formal training programs	9.6	9.3	6.3	10.0	7.9
Informal training by management	51.9	55.8	58.1	53.8	41.0
Informal training by coworkers	25.6	26.9	25.2	22.7	27.1
Investment in training time	147.1	156.5	148.9	147.3	118.0
Weeks to become fully trained	7.8	8.3	7.9	5.8	4.8
Reported Productivity					
Ratio first 2 weeks to 2 years	.60	.59	.58	.60	.64
Ratio next 10 weeks to 2 years	.79	.79	.78	.81	.83
Ratio of Productivity Net of Training Costs in First 3 Months to Productivity of a Worker with 2 Years Tenure					
Liberal assumptions	.46	.44	.44	.47	.55
RP (true) = 0	.72	.70	.71	.72	.77
Conservative assumptions					
RP (true) = RP (meas)	.55	.53	.52	.56	.62
RP (true) = .5 RP (meas)	.67	.66	.66	.68	.72
RP (true) = 1.5 RP (meas)	.42	.40	.38	.44	.52
Number of cases	557	326	192	304	114

Note: Sample is limited to jobs for someone hired less than 2 years earlier and for which all the necessary questions on wage rates, training time, and productivity were answered.

training. The wage increase in jobs offering almost no training in skills that are useful at other firms is much smaller and can probably be fully accounted for by inflation. The lack of any wage progression with tenure in these jobs suggests that employers pay for and receive almost all the benefits of specific training.

The second panel of table 3-1 reports answers to questions about the number of hours devoted to four distinct training activities. Training for jobs with the most general training and many local competitors involves an average of 49 hours watching others do the job, 9.6 hours in formal training, 52 hours in informal training by management, and 25.6 hours in informal training by co-workers in the first 3 months. The time devoted to training has a value equivalent to 147 hours of an already trained co-worker's time. As long as some of the skills taught are general, the required training time seems to be unrelated to the reported degree of generality. However, jobs reported to teach almost no skills useful in other firms (i.e., have training that is completely specific to the firm) require less training--118 rather than 147 hours in the first 3 months.

The final row in the panel reports the geometric mean of the answers to the question "How many weeks does it take for a new employee hired for this position to become fully trained and qualified if he or she has no previous experience in this job, but has the necessary school-provided training." Jobs for which only some or almost none of the skills are useful in other firms take an average of 5 or 6 weeks to learn.

This training seems to have the hoped for results of increasing the productivity of the new employees. The third panel of the table presents ratios of the reported productivity of new employees to the reported productivity of those with 2 years of tenure. During the first 2 weeks, the typical new employee at firms offering general training is reported to be only 59-60 percent as productive as the typical worker with 2 years of tenure and experience. During the next 10 weeks at the firm, the typical new employee's productivity is reported to be 79 percent that of a worker with 2 years of tenure. As one would expect, the reported productivity of new employees increases more rapidly in the first month or so than it does later. The increase in the worker's reported productivity seems to be considerably greater than the 8 or 9 percent increase in the worker's wage after accounting for the inflation of scale wage rates.[11] This occurs despite the fact that the training is reported to be almost entirely general and there are many local firms that use the skills in question.

The bottom panel of table 3-1 presents estimates of the ratio of productivity net of training costs in the first 3 months of employment to the productivity of a typical worker with 2 years of tenure in the firm. The sensitivity of these estimates to the assumptions about the scaling of the productivity index can be examined by comparing the rows. Our preferred estimates, those calculated using conservative assumptions, are in the third row of the panel. The conservative estimate is obtained by subtracting the value of time expended by others--management and co-workers--from the estimate of the new worker's productivity.[12] The liberal estimate of productivity net of training costs assumes that the trainee produces no current output when receiving formal training or watching others do the work, and, therefore, subtracts the value of the trainee's time devoted to formal training or watching others do the work from the previously described conservative estimate of productivity net of training costs.[13] The estimates are presented in the first row of the bottom panel. The second row of the panel presents estimates based on the extreme assumption that productivity per hour engaged in a nontraining activity does not increase during the first 2 years on the job at all. Time fully devoted to training (i.e., the training time investment reported in row 5 of the second panel divided by 520) is subtracted from 1 to produce the estimate of the productivity net of training cost ratio.

The fourth row of the panel presents estimates that are based on the assumption that the reports of productivity differences supplied by our respondents exaggerate true proportionate differences in productivity by a factor of two. The fifth row of the panel presents estimates that are based on the assumption that proportionate differences in true productivity between new and experienced workers are 50 percent greater than those reported. These two rows aggregate time estimates and productivity differences using the conservative assumption that the lower productivity reported for new workers reflects in part the portion of their time that is devoted to formal training and watching others do the work.

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The 1982 National Center employer survey found that the time others spend training a new employee during his or her first 3 months has a value equal to 19 percent of the productivity of a worker with 2 years tenure. The survey also found that the average new employee spends 11 percent of his or her time in the first 3 months either watching others do the job or in a formal training program. The survey did not, however, ask questions about the time devoted to training after the first 3 months on the job. Consequently, the ratios reported in the bottom panel compare reported productivity net of training cost in the first 3 months to reported productivity at the end of the second year. A calculation of the ratio of productivity net of training costs at these two points in time requires that the value of time devoted to training be subtracted from the denominator as well as the numerator. A rough estimate of the correction needed can be obtained by consulting a 1983 National Center survey of employers that did ask about time devoted to training in the second year of employment (Hollenbeck and Smith, 1984). It found that in the second year on the job the proportion of time devoted to a full-time training activity was about one half of the corresponding proportion of the first month.[14] This means that a rough estimate of the rate of growth of productivity net of training costs can be obtained by dividing the numbers in the bottom panel of table 3-1 by 0.905 when conservative aggregation assumptions are being used and by 0.85 when liberal aggregation assumptions are used.

Tests of our central hypothesis--that productivity net of training costs rise more rapidly than compensation during the first 2 years in a job even when the training is reported to be completely general--are presented in table 3-2. This involves testing the null hypothesis, H_0, which states that the ratio of productivity net of training cost in the first 3 months to productivity net of training cost at the end of 2 years, NP_s/NP_{2yr}, is equal to or greater than the ratio of hourly compensation at these 2 points in time, W_s/w_{2yr}. The hypothesis is tested under three different maintained assumptions about the validity of our measures of relative productivity, and for two alternative assumptions about how to aggregate reports of trainee productivity and the time others devote to the new employee's training. The adjustments necessary to calculate estimates of the ratio of starting 2 year productivity net of training costs were described in the previous paragraph.

TABLE 3-2

T-TESTS OF THE HYPOTHESIS THAT PRODUCTIVITY NET OF TRAINING COSTS RISES FASTER THAN WAGE RATES IN JOBS WITH GENERAL TRAINING AND MANY COMPETITORS

Definition of NP	$H_1: \frac{NP_s}{NP_{2yr}} - \frac{W_s}{W_{2yr}} - .08 < 0$		$H_1: \frac{NP_s}{NP_{2yr}} - \frac{W_s}{W_{2yr}} - .03 < 0$		$H_1: \frac{NP_s}{NP_{2yr}} - \frac{W_s}{W_{2yr}} + .02 < 0$	
	All Hires	Recent Hires	All Hires	Recent Hires	All Hires	Recent Hires
Liberal assumptions	18.8	18.4	16.0	15.2	13.2	12.0
Conservative assumptions	18.4	17.6	15.2	14.6	12.0	11.6
RP(true) = .5 RP (measured)	12.1	12.2	8.2	8.6	4.3	5.0
RP(true) = 0	7.4	7.9	1.9	2.[illegible]	NS	NS
Number of cases	676	557	676	557	676	557

Note: The hypothesis tests assume NP_s/NP_{2yr} and W_s/W_{2yr} are independent. It is as more likely their covariance is positive, t-statistics would be even higher. The column titled Recent Hires uses statistics reported in table 3-1 and is based on jobs for which there was a hire less than 2 years ago. Ws is the nominal starting wage of people who began work an average of a year before the interview, so 0.08 was added to W_s/W_{2yr} in the first 2 columns. The 2 right-hand columns assume that 2 years of tenure raise fringe benefits enough to increase the rate of growth of compensation by 10 percent. This implies that (0.08-0.10) should be added to the W_s/W_{2yr} when testing the hypothesis.

The estimate of the relevant wage ratio, w_s/w_{2yr}, was obtained by adding 0.08, the rate of growth of adjusted hourly wages from the second quarter of 1981 to the second quarter of 1982, to the wage ratio presented in the first row and column of table 3-1.

The first 2 columns of table 3-2 report hypothesis tests that are conditional on the maintained assumption that the rate of growth of compensation (i.e., wages plus fringe benefits) and wage rates are equal. The next 2 columns of the table are based on a maintained assumption that compensation typically rises 5 percent faster than wage rates during the first 2 years on a job.[15] The 2 columns on the far right hand side of the table are based on a maintained assumption that compensation typically rises 10 percent faster than wage rates during the first 2 years on a job.

The t-statistics reported in the table imply a decisive rejection of the hypothesis that the rates of compensation for jobs reported to offer completely general training rise at a rate that is equal to or greater than the rise in productivity net of training costs. The finding that in the first 2 years of tenure compensation rises less rapidly than productivity net of training costs is quite robust. If compensation rises no more than 5 percent faster than wage rates, the hypothesis is rejected even when we make the truly extreme assumption that, although respondents report to the contrary, there is no increase in worker productivity in the first 2 years on a job. If compensation increases 10 percent faster than wage rates, the hypothesis is rejected even when it is assumed that the true increase in relative productivity with tenure is only half of what was reported by our respondents.

These results can be viewed as evidence that in the first year or so on a job the forces tending to cause wages to grow more slowly than productivity net of training costs are stronger than those having the opposite effect. This is true even when the training is reported to be general.[16] The forces that tend to cause starting wage rates to be higher than productivity net of training costs and therefore wage growth to be slower than the growth of productivity net of training costs are--workers facing higher interest rates when they borrow than firms and sources of job-worker match specificity such as sorting, costs of transfer, specific training and extra general training that is not recognized by others in the labor market. The forces that work in the opposite direction are the need to design wage structures to attract those with low quit probabilities (Salop and Salop, 1976), and to reduce shirking (Lazear, 1981). The great deal of specificity to job-worker matches that is impled by these results means that turnover is extremely costly for the worker, the firm and society.

3.5 Are Private Decisions About On-The-Job Training Socially Optimal?

The models developed in this chapter can be used to analyze the social optimality of the amount of on-the-job training specified in the employment agreement. The socially optimal amount of general training is defined as the amount that equates the 2 sides of (13):

$$(13)\quad C_g(g,h) = D_s = \frac{1}{1+r_s} = \text{Society's discount factor.}$$

An examination of the condition determining the level of general training suggests two reasons for expecting firms and individuals to underinvest in general on-the-job training. The first reason is that some firm-to-firm variations in general training are not recognized by other employers. If all discount factors are the same, denoting the retention rate, Pr(S) Pr(K), by R and dropping the second order effects (see appendix B) the condition determining the level of general training becomes--

$$(14)\quad C_g(g,h) = D_s[1-(1-R)(1-b)].$$

The fact that the expression within the brackets is less than one implies that the private payoff to training is smaller than the social payoff and therefore that there is underinvestment in general OJT. Expressed as a proportion, the discrepancy between the two is $(1-R)\cdot(1-b)$, the separation rate times the errors in measurement bias in rewarding increases in general training. The discrepancy and, therefore, the tendency to underinvest in general training is related positively to the separation rate and related negatively to the quality of the signals available to other firms for predicting the amount of general training received at the firm being modeled.

The second reason why investment in general on-the-job training is below the social optimum is that the workers who must invest in general OJT typically demand much higher before-tax rates of return than society would demand.

If general training is fully perceived by other firms, (b=1), the equilibrium level of general training will equate the individual's trade-off of future before tax dollars for present before tax dollars, D_b, to the marginal cost in the first period of one before tax dollar of general human capital in the second period, $C_g(g,h)$. If tax rates are part of the model, the discount factor is

$$D_b = \frac{1}{(1+r_b)}\frac{(1-t_2)}{(1-t_1)}$$

where t_1 and t_2 are marginal tax rates in the first period and the second period and r_b is the individual's rate of time preference. A rise (fall) in D_b produces a rise (fall) in training investment.

Because of the progressiveness of the income tax and the individual's poor access to credit, D_b is almost certainly smaller than D_s, the social discount factor. The costs of OJT are expensed in the year they are incurred, so, if all individuals paid taxes every year and faced the same marginal tax rate every year, the tax system would have neutral effects on OJT investment.[17] However, investments in OJT are typically made at a time when the individual has no tax liability or a lower than normal marginal tax rate and the benefits are received when earnings and marginal tax rates are higher. This phenomenon reduces the size of D_b. Secondly, the discount rates that individuals use to calculate the present value of returns to OJT are considerably higher than both the firm's internal rate of return and the social rate of discount. This occurs because most young workers are unable to borrow to finance investments in OJT and because those loans that are available (e.g., time purchase of a car or an appliance) carry extremely high interest rates. Government-guaranteed and subsidized loans are available for financing schooling but not for financing on-the-job training.

When both these effects are operating, the expression that characterizes the ratio of private to social rates of return for an investment in general human capital is--

$$\text{(15)}\quad \text{Ratio private/social returns} = (D_a(1-b)R + D_b b)/Ds$$

$$= R(1-b)\frac{(1+r_s)(1-t_2)}{(1+r_a)(1-t_1)} + \frac{b(1+r_s)(1-t_2)}{(1+r_b)(1-t_1)}.$$

For specific human capital, social optimality is the level of training that equates the marginal cost of specific training, $C_h(g,h)$, to the retention rate divided by the social discount rate, $R/1+r_s$. Private decision making results in specific training investments that equate $C_h(g,h)$ to $R(1-t_2^f)/[(1+r_a)(1-t_2^f)]$. Thus, for specific human capital, the ratio of private social returns is--

$$(16)\quad \text{Ratio private/social returns} = \frac{(1+r_s)(1-t_2^f)}{(1+r_a)(1-t_1^f)}$$

Since the firm typically does not concentrate all its specific OJT investments in one period and receive all the returns in another, the marginal tax rates in the first and second periods are not likely to be systematically different. Firms that do not have good access to the capital market may have before tax internal rates of return that considerably exceed the social rate of discount. This will cause such firms to underinvest in all forms of human and physical capital. However, the firm's internal rate of return will typically be below the discount rates being used by its newer employees. For this and other reasons, the discrepancy between private and social returns is likely to be smaller for specific training than for general training.

The assumption that many of the costs of producing general and specific training are joint implies that the marginal cost of a dollar of specific human capital depends upon the amount of general training and vice versa. If the cross partial of the cost function C_{hg} is positive and almost the size of the second partial, C_{gg}, the two forms of training are close substitutes and a distortion that causes underinvestment in general training will result in extensive substitution of specific for general training. If the cross partial of the cost function is negative, a distortion that causes underinvestment in general training will also reduce specific training. This means that if workers and their employers are underinvesting in general OJT for any of the reasons cited above--high discount factors, rising marginal tax rates, lack of market perception of OJT quality--the firm's decisions about the amount of specific training to undertake will also tend to be distorted as well. There is no way of knowing, a priori whether the spillover distortion of the specific OJT decision will increase or decrease specific OJT. What does this discussion imply about the social optimality of investment in specific OJT? Underinvestment in specific human capital is not as serious a problem as underinvestment in general human capital, so stimulating specific OJT has lower social priority than stimulating general OJT. In addition successfully stimulating general OJT will tend to reduce distortions of specific OJT.

In summary, workers and firms tend to underinvest in general training. This occurs for four reasons--

- the worker's discount rate (the rate at which the worker can borrow and therefore tradeoff future consumption for current consumption) is considerably higher than the social discount rate (the interest rate on government bonds)
- the tax rates faced by the worker when the returns to the investment are being received are typically higher than the tax rates when the costs are being incurred
- other employers do not accurately perceive the quality of the general OJT received by the worker and as result do not fully compensate the trained worker if he/she receives good training
- the minimum wage. If a minimum wage constraint is binding the starting wage on a job will have to be higher than it would otherwise have been and this increases the cost of training and thus reduces its amount. A second impact of the minimum wage is that the higher starting wage it causes is partially compensated for by a fall in the wage rate in the post training period. This increases the quit rate which in turn reduces the payoff to training and therefore the amount of training.

If the interest rates facing employers are higher than the social discount rate there will also be underinvestment in specific training. The degree of underinvestment in specific training is considerably smaller than the underinvestment in general training.

From the point of view of public policy, the most important conclusion from our economic analysis of on-the-job training is that from society's point of view employers and employees underinvest in general on-the-job training. There is a good deal of empirical evidence supporting this finding. If there is underinvestment in general OJT we would expect to find private rates of return to OJT to be very high. The studies that have estimated the return to OJT do find that rates of return are very high. Harvey Rosen (1982) found, for instance, that after adjusting for inflation the real rate of return to

OJT investments by the worker was 12.6 percent per year for those who went to college and 19 percent for those who did not attend college. These rates of return are considerably higher than the real rates of return of about 4 percent on corporate bonds and of about 5 percent for schooling. Mincer (1974) estimated the rates of return to be even higher.

The data presented in table 3.1 also supports a conclusion that total rates of return (combining both worker and employer benefits and costs) to OJT in the first few months of employment are extremely high. Our respondents report that in the third through twelfth week of employment, productivity is 16 percent higher on average than in the first two weeks. Since the training that produces this dramatic increase in productivity is occurring over the course of only two months, the calculated costs of this training are not likely to exceed two months of output from the new worker. If so the average rate of return to this training exceeds 100 percent. The employers we interviewed reported that over the course of the next 21 months up to the worker's second anniversary at the firm that productivity typically increases another 12 percent. Average rates of return on the training investments that produce this productivity gain will not be 100 percent but they are many times higher than the real rates of return to corporate bonds and schooling.

A different type of evidence for underinvestment in general on-the-job training is provided by Bishop's (1982) study of the social payoff to occupationally specific training. By comparing two new hires in the same job with differing amounts of experience, he obtained the result that compared to zero experience, 5 years of relevant work experience reduces the training required by 22 percent and increases productivity by 16 percent in the first two weeks, 11 percent in the next 10 weeks and 6 percent after about a year at the firm. The key finding is that these increases in productivity and savings in training costs are larger than the extra wages offered these workers. This means that on-the-job training at employer A not only benefits the employee and employer A (as implied by Becker's theory of OJT) but also benefits other employers in the industry who hire workers who quit or are laid off by employer A. In other words, OJT creates externalities--social benefits that are not captured by either the trainer or the trainee. The market failure that is implied by this finding is justification for governmental efforts to stimulate the externality creating activity--general on-the-job training.

How might government induce firms and workers to increase investments in general on-the-job training? Four different approaches will be evaluated: (1) lower taxes on the returns that the employer receives from training investments (2) lower taxes on the returns the employee receives from training investments (3) subsidize the costs of training investments and (4) abolish the minimum wage for jobs that offer considerable training.

The first two options are not viable because the returns to a training investment cannot be administratively distinguished from the returns to other investments and general reductions in tax rates (both during and after training) do not increase the incentives to invest in training. It has been demonstrated both theoretically and empirically (Hashimoto, 1982; Bishop, 1982) that the minimum wage reduces general OJT so reductions in the minimum would increase general OJT somewhat. Eliminating the minimum wage would not, however, end or even significantly reduce the underinvestment in general OJT. The reason is that the minimum wage is a binding constraint for only a small minority of jobs and even in its absence underinvestment in general OJT would occur for a variety of other reasons.

This leaves us with a subsidy of the costs of general training as the only policy that might significantly increase general on-the-job training. Since general OJT typically gets mixed together with specific OJT and both occur simultaneously with actual production, the primary barrier to subsidizing general OJT is finding a way to measure it. One way society can promote on-the-job skill training without having to have a comprehensive solution to the measurement problem is for community colleges (or some other public agency) to establish cooperative training ventures with specific local employers in which teachers on the college's payroll provide training that meets that employer's specifications but is also useful at other firms. Many states and localities now offer this kind of aid to companies that open or expand plants in the community. Publicly subsidized institutions seem to be becoming increasingly important providers of skill training that is customized to a particular employer's needs. It is not clear, however, that publicly controlled institutions have a comparative advantage in this type of activity and that lacking the public subsidy they would be effective competitors in this market. If not, efforts to promote on-the-job skill training might better be focused on offering the subsidy to the worker or firm and letting them choose who shall provide the training.

An alternative way of encouraging collaboration is to offer subsidies to employers that offer training that is integrated with a school or college's curriculum (the Targeted Jobs Tax Credit offers such a tax credit for hiring disadvantaged high school cooperative education students). Another approach might be to offer young people leaving high school a voucher/scholarship that can be used to buy training from an employer as well as to pay college tuition. Still a third approach would be to offer a tax credit to employers that provide certain approved kinds of training. The major difficulty with the latter two approaches is that one cannot subsidize something one cannot measure, and measuring OJT is notoriously difficult. The measurement problem can be solved, however, and the final section of the paper presents two practical proposals of how on-the-job training might be subsidized.

Marginal Training Subsidy

A marginal training subsidy (MTS) would offer a partial subsidy of training expenditures above a threshold level. The rate of subsidy or tax credit would be set somewhere between 10 and 33 percent. The training costs that would be eligible for subsidy would include payments to industry training funds, tuition reimbursements for job related training, contributions of materials or staff time to vocational/technical institutions, the budgeted costs of the firm's formal training of new and continuing employees, and certain of the costs of informal training of new and upgraded employees.[19] Participating companies with more than 100 employees would be required to have a training advisory committee that contains worker representation.

While the measurement of the costs of informal training is difficult, it must be attempted if choices between formal and informal training are not to be distorted.[20] The subsidizable costs of informal training would be limited to trainee time and trainer time during the first year of employment or during the first 3 months before or after a major promotion and change in job responsibility. If the training is formal, certain additional expenses--books and materials, rental on teaching machines and equipment or office space dedicated entirely to training, and payments to training vendors--would be eligible for subsidy. Formal training would be subsidizable regardless of length of tenure and whether the worker is receiving a promotion. At the conclusion of the training program or the firm's fiscal year, the employer would be required to award each trainee a certificate describing the number of hours of formal or informal training provided/attended, skills taught and where appropriate, the competence achieved.

The threshold which must be exceeded before a subsidy or tax credit would be paid would be equal to 10 percent of the firm or establishments wage payments to employees with less than one year of tenure at the firm plus 1.5 percent of wage payments to all other employees. The threshold is higher for firms with many new employees because (a) new employees tend to receive more training than continuing employees and (b) the costs of informal training are subsidizable only during the first year on the job and for a short period after a promotion.

A subsidy above a threshold has some important advantages over an obligation to spend a minimum amount on training:

- Firms that are big trainers (and therefore probably efficient trainers) of skilled workers would always face an incentive to expand their training.
- In France where there is an obligation to spend 1 percent of wage bill on training the great majority of employees work at firms which exceed their obligation to spend on training so at the margin, there is no public encouragement of additional training for the majority of French workers. A subsidy above a threshold avoids this problem.
- Paperwork is reduced because most firms would not apply for a subsidy in most years. Year-to-year variations in training expenditures are likely to be large at small firms. Such firms would most likely spend above the threshold only in years in which there is a major expansion of employment or the installation of new equipment.
- Employers who feel the administrative burdens of the subsidy are too high, are free not to participate.

All employers--profit making, non-profit and governmental--should be eligible for the marginal training subsidy if their training expenditures exceed the threshold defined for their organization.[21] In order for incentive effects to be maximized, employers must feel they are assured a larger subsidy payment if they increase their firm's training investment. Together these two considerations imply that the MTS should be administered as a subsidy entitlement, as a tax credit against a broad based tax on the firm's wage bill like FUTA or social security, or as a tax credit against income taxes that can be sold to other firms.[22] The MTS would be financed either out of general revenue or a special training tax on the wage bill of all employers. In order to give firms time to set up the accounting procedures to record training expenditures, it would be phased in at least a year after the legislation is passed.

The MTS has a number of important advantages:

- The social benefits of on-the-job training are probably just as large as the social benefits of occupationally specific training provided by schools. The MTS would create an incentive for firms and workers to generate more of such benefits and would reduce currently prevailing distortions of the choice between these two modes of providing occupationally specific training.
- Since the employer pays 67 to 90 percent of the cost of training, there is always an incentive to do the training in the most efficient manner possible.
- Choice of which jobs to train for and how to do the training is made by the employer not by an educator, a government official or by the trainee. The employer is the person best able to project the firm's future need for skilled workers and to select the best method of training for those skills.
- The inclusion of the costs of informal training in the definition of subsidizable training expenses is fair to small business and reduces the tendency of the subsidy to distort choices between formal and informal training.
- While the MTS is not directly targeted on the unemployed dislocated worker, it will reduce unemployment nevertheless. The MTS reduces unemployment in two ways:
  - It encourages firms to hire and train new workers; and to retrain rather than lay-off workers whose skills were becoming obsolete.
  - It encourages the firm to expand the supply of skilled workers rather than engaging in a bidding war for the limited supply of already trained workers thus producing an acceleration of inflation.
- The MTS should discourage turnover. A firm with high rates of turnover will have a higher threshold and will as a result receive a smaller subsidy payment.

The MTS has as its objective expansion and intensification of on-the-job training. Only two small reforms of current practice are proposed--training advisory committees at firms with more than 100 employees and providing the trainee a certificate describing the training that has been received.[23] All the really important decisions--who is to be trained, what is to be taught, workers influence these decisions by bidding for jobs that require training, by selecting an employer who provides the desired training, and the commitment that is given to learning the material that is presented).

Employers and workers probably invest nearly $100 billion of time and resources in formal and informal on-the-job training each year. Consequently, covering all employers and all kinds of training inevitably means costs can be kept down only if the subsidy rate is set rather low, the definition of subsidizable expenditure is restrictive and the threshold is set rather high.

A Critical Skills Training Incentive

An alternative approach to promoting more private investment in on-the-job training is to target certain critical occupations that are experiencing severe shortages. A subsidy would be offered for training newly hired and/or transferred employees in a few selected occupations.

Selecting Skills for Which to Provide Training Incentive. Legislation would restrict the subsidy to a limited number of industries that currently export a major share of their output, or are service firms that provide specialized high tech services.[24] To be eligible for a training subsidy, an occupation/skill would have to involve considerable initial on-the-job training, be required at many firms, and be in shortage. The determination of whether an occupation is in shortage would be based on current data on changes in relative wage rates, changes in vacancy rates or newspaper advertising if available, and on recent and projected growth of demand for the skill.[25] The Department of Labor would be given a fixed budget and empowered to select a limited number of skilled jobs for which training subsidies would be available.

Once an occupation had been selected as a potential candidate for subsidy the Secretary of Labor would appoint an industry/labor committee to make recommendations regarding the definition of the critical skill, the competencies that a trained individual would be expected to have, and possible mechanisms to insure that subsidized trainees achieve these standards. The Department of Labor would do a small survey of the costs of training and the length of the training period that would serve as a basis for calculations for median training cost.[26] The Secretary of Labor would be empowered to make competency certification (under the auspices of a multi-employer or union umbrella organization) a part of the mechanism for defining eligibility for a critical skills training subsidy.[27]

Administration of the Training Incentive. Application for a subsidy of a particular trainee must be made within one week of the start of the training (within one week of the date of beginning work in the case of a new hire).[28] The requirement of immediate application for the training subsidy has three purposes: (1) by forcing the firm to be aware of the subsidy when it begins the training, it maximizes the subsidy's incentive effect and reduces retroactivity, (2) it allows DOL to continuously monitor the number of trainees its program has stimulated, and to project future costs and the fullfillment of its goals, (3) for the firm it locks in the terms and conditions of subsidy that prevailed at the date training was commenced. If DOL determines that more (less) training is being undertaken than needed or was budgeted, it has the right without advance notice to restrict (liberalize) the definition of subsidizable jobs/skills, lower (raise) the training cost allowance or end that occupation's eligibility. Changes in rules would apply to all training programs begun one week or more after the announcement of the change.

There would be no limit to the number of trainees for which an employer could be subsidized, and the firm would not have to obtain advance agreement from DOL as to this number. The employer would only have to certify (1) that the training he provides results in the worker's attaining the critical skill, and (2) that the trainees did not have that skill prior to the training. This certification would be audited on a random basis.[29] Workers who complete training would be awarded a certificate attesting to the skills they have achieved. The skills taught by the training program would be described in detail either on the back of the certificate or on an attachment.

The administration of this Critical Skills Training Incentive has been described in considerable detail for several reasons:

- the popularity of the program with employers will depend upon how easy it is for them to administer it,

- the power of the incentives it produces and the cost of the program may depend upon seemingly minor administrative matters (such as when application for subsidy must be made),
- the primary concern about proposals such as this is whether they can be administered, so there needs to be a demonstration of the feasibility of the program.

The plan described has a number of attractive features:

- It is limited in scope to occupations in critical shortage.
- Great flexibility is given to program administrators. (This is essential because the very concept of the program is new and because it must quickly respond to the changing needs of the economy.)
- Workers who complete training are awarded a certificate that describes the skills they have gained.
- The firm always faces a marginal incentive to expand its training of targeted skills. It does not have to get prior agreement from DOL about how many people to train (an administrative hassel that would be a major barrier to participation).
- The firm is given an incentive to retain the workers it trains.
- Despite the almost 'entitlement' nature of the training subsidy, its total cost is capped by the monitoring of usage and DOL's ability to lower subsidy amounts and tighten eligibility.
- A sunset provision automatically ends a skill's eligibility for subsidy.
- Cost could be further reduced by requiring that firms already employing people in the targeted skilled occupations exceed a given level of training before being eligible for subsidy. It could be assumed that in the normal course of events such firms would have to replace 10 percent of their stock of workers with the targeted skills anyway. The subsidy could be paid for trainees above this threshold.
- The firm's administrative costs are kept low. The firm does not have to calculate and report how much it is spending on training.
- Eligibility for subsidy is a function of an output--the number of people trained for certain specific jobs--not a measure of input. This creates a strong incentive to be as efficient as possible in doing the training.

The Critical Skills Training Incentive has some important drawbacks, however. Its success depends upon the wisdom and timeliness of the selection of skills for which training subsidy is provided. Experience with federally funded graduate fellowships should remind us how difficult it is for government to forcast future demand for a specific skill and implement decisions to extend or withdraw training subsidies in a timely manner. Graduate fellowships were originally targeted on a few shortage fields thought to be critical to national defense. However, other fields campaigned to be included and new programs were started until almost every field of study was included in at least one agency's fellowship program. The number of fellowships expanded even after the shortages of PhD holders that gave rise to the programs were replaced by surpluses. The CSTI has features--the sunset provision, great administrative flexibility and a fixed budget--that are intended to prevent a recurrence of the poor timing that characterized the graduate fellowships programs. There is always the possibility, however, that the projections of future demand will be wrong or that politics will result in the wrong occupations being selected and that the selective nature of the training incentive would increase rather than decrease market distortions.

FOOTNOTES

1. Comparisons of rates of productivity growth and rates of wage growth were made under an assumption that reported productivity was a proportional transformation of true productivity plus a random error. During the first 6 months, reported productivity grew considerably faster than wage rates. After the first 6 months, rates of wage and productivity growth were approximately equal. As with Medoff and Abraham, these results do not take into account reductions in the amount of time others spend training the new employee as the worker gains tenure. Growth rates of productivity net of training costs are inevitably higher than growth rates of productivity alone. These results are very similar to those reported in this paper and are consistent with the theory that is developed in section 3.2.

2. The job of predicting firm to firm variations in general training is made harder by the fact that there are thousands of types of general human capital only some of which will have value in a particular firm. To keep things simple, however, the model assumes only one form of general human capital.

3. Studies of quit and layoff rates typically obtain wage elasticity estimates that are considerably below one (Bishop 1981). This implies that the elasticities of stay and keep rates are even lower and that $(D_a\phi w_g^3 \Pr(K)D_k - D_b\phi_o G_k)$ is very small (See appendix B for an extended discussion of why these terms are very small).

4. $\phi_o G_k$ may be rewritten as $\Pr(K)\eta_o(G_k/w)$. Since both G_k/w, the ratio of the worker's quasi-rent to the wage is small, and η_o the wage elasticity of the proportion of new hires that are kept is small, the third term of (11) will be small.

5. Note that the sample is representative of on-the-job training provided by a group of employers, not the training activity associated with the employment of a group of job seekers during a specified time frame. The sample most likely underrepresents larger employers if the employment of a group of job seekers over a specified period of time were to be considered.

6. In a few cases, employers reported that more than 520 hours (13 weeks times 40 hours a week) had been devoted to a specific training activity during the first 3 months on the job. While the new hire might have received training from more than one supervisor, it is unlikely that two trainers were simultaneously in one-on-one contact with the new hire. Consequently the computer edit of this data changed all reports of more than 520 hours involved in a training activity to 520.

7. The cost of the trainer was assumed to be two-thirds of the foregone productivity, since formal training often involves more than one trainee. Thus 1.8 = (2/3)1.5 + .8.

8. The index was constructed under an assumption that the four training activities were mutually exclusive. This implies that if the sum of the hours devoted to individual activities is greater than 520, that a reporting error

has occurred which overstates investment in training. In the few cases where the sum of hours devoted to training exceeded 520, the training time index was adjusted downward by the ratio of 520 to the sum of the hours reported for individual activities. This procedure reduces the mean of the index by about 10 percent.

9. The interview questions about the productivity of recently hired employees were intended to provide indicators of the relative productivity of one worker at different points in time or two different workers in the identical job. They do not attempt to measure productivity in any absolute sense and therefore are not comparable across firms. Some of the uses made of these data only require that the index be correlated with true productivity. Estimates of the magnitude of training investments that combine time inputs of other staff with the lower productivity of the trainee require an assumption that the index is cardinal and a proportional transformation of true productivity plus a random error. The questions asking for a rating of the productivity of particular workers have remarkably low nonresponse rates. Only 4.4 percent of respondents asked about a particular new hire's productivity during the first 2 weeks responded with a "don't know" or refused to answer. Comparably defined nonresponse rates for other questions about the new hire were 8.2 percent for previous relevant experience, 3.2 percent for age, 6.7 for education, 8.6 percent for time spent in informal training by a supervisor, and 5.7 percent for a 3-question sequence from which starting wage rate is calculated. The low nonresponse rate implies that our respondents felt that they were capable of making such judgments and augurs well for the quality of the data that results.

10. If employer reports of a worker's productivity are equal to an unknown constant times the worker's true marginal product plus a random error, percentage differences in cell means of the productivity index can be interpreted as unbiased estimators of percentage differences in true productivity. If the variations in the productivity scores assigned by supervisors exaggerate the proportionate variations in the true productivity, our estimates of percentage impacts of recruitment source on productivity will be biased upward. Even though it is possible for a worker's true productivity to be negative, the scale was defined as having a lower limit of zero. Floors and ceilings on a scale typically cause measurement errors to be negatively correlated with the true value. If this were the case the result would be an understatement of percentage differences between the productivity of new hires and workers who have been at the firm for longer. In our view this latter type of bias is more likely than the former.

11. This statement is conditional on the assumption that the productivity reports received from employers are a proportional transformation of true productivity plus a random error. Tests of the sensitivity of the comparison between the growth of wage rates and productivity net of training costs to this assumption appear shortly.

12. The following assumptions produce this calculation: employer reports are a constant times true productivity plus a random error, the managerial and co-worker time reported; to be devoted to training is 100 percent devoted to training as reported, the managerial staff members who provide training are

paid 1.5 times what workers with 2 years of tenure earn; and the reported lower productivity of new workers relative to those with 2 years of tenure captures the loss of trainee productivity because of training activities.

13. The first three assumptions are the same. The fourth assumption is that the productivity scores that are assigned describe the trainees' contributions to current output when they are not engaged in training activities and when receiving informal training by management or co-workers. During the other two kinds of training activities (formal training and watching others do the job), the trainee is assumed to contribute nothing to current output.

14. When the ratio derived from the 1983 survey is multiplied by the 1982 estimate of value of training in the first 3 months, we estimate that workers with 2 years of tenure spend 5.5 percent of their time in formal training or watching others do the work and that the time others spend training him or her has a value of 9.5 percent of his or her productivity. One minus this latter figure is the appropriate correction factor for the denominator when conservative aggregation assumptions are used. For liberal assumptions the appropriate correction factor is one minus the sum of these two figures.

15. Compensation may grow faster than wage rates early in a worker's tenure if some minimum amount of tenure is necessary before pensions vest or paid vacation can be taken.

16. Even when skills and training are all general in the sense of being useful in other firms, workers with general training will typically be more productive in the firm that has done the training than in other firms. This is because each firm is likely to require a different mix of general skills. The firm that does the training will concentrate on those skills it needs the most, some of which may not be as highly valued by alternative employers. Skills that would be highly valued by an alternative employer may not be taught because others on the staff already fulfill that function or because of some idiosyncracy of the training firm's production technology. The result is that the best fit between a worker's skills and the employer's needs is more likely to be at the firm that initially provides the training. This phenomenon has the effect of giving specificity to the match even when all training is general, and of reinforcing the tendency of wages to rise more slowly than productivity net of training cost.

17. The tax treatment of investments in physical capital with lives of 10 or more years is less favorable than the treatment of investment in human capital. The investment tax credit combined with ACRS makes the tax treatment of equipment with a tax lifetime of 8 years or less roughly equivalent to immediate expensing.

18. An increase in 1-b, the errors in measurement bias, will increase the discrepancy only if $[R(1-t_2')/(1+r_a)(1-t_1')] < [(1-t_2)/(1+r_b)(1-t_1)]$. The high rate of turnover among new hires means that this condition will almost invariably be fulfilled.

19. To insure that only training gets subsidized/not vacations or motivational sales meetings, subsidizable expenditures might be defined to exclude (1) travel to a remote site other than the company's national or the appropriate regional headquarters, (2) housing and food expenses of more than $100 a day, (3) costs of training non-employees, part time employees working less than 50 hours a month or employees for whom more than 50 percent of compensation comes from commissions, (4) payments to speakers or presenters of a training session of more than $1000 or $200 per contact hour which ever is higher. The costs of developing a training package or system for use in training ones own staff would be an allowable expense.

20. A trainee would be considered to be engaged in formal or informal training if he or she is receiving group instruction, being instructed by a computer, reading manuals or instruction booklets watching others do the work or being shown the work. A trainer, supervisor or coworkers time would be considered to be engaged in a training activity only if 100 percent of the trainers attention is devoted to the training purpose. If any output is produced during a training activity it would have to be given to the trainee, discarded or given away. The following tests could be used to define a promotion for purposes of calculating subsidizable training expenses: there would have to be a new job title, noticeably different job duties and a wage increase of at least 6 percent above the standard seniority or cost of living increment and the individual could not have held that particular job before. In order for new employee training to be subsidizable it would have to be associated with a wage increase by the end of that year of at least 10 percent over and above the rise in the cost of living.

21. To insure that employers who receive an MTS subsidy were aware of the program at the time it might influence their behavior, it could be required that the employees make a preliminary application before July 1 of the calendar year for which a subsidy is sought.

22. If the MTS is a subsidy, subsidy payments would be taxable income. If the MTS is a tax credit the firm would have to reduce its reported social security or FUTA tax payments by the amount of the tax credit.

23. To the extent that the accounting rules used to distinguish training activities from production activities affect the way training is conducted this is an unfortunate unintended consequence of the necessity of defining a dollar quantity of training expenditure for each firm.

24. Examples might be communications, machinery, instruments, chemicals, pharmaceuticals, electronics, computer service and R & D laboratories.

25. For a skill to be eligible, both recent and projected rates of growth would have to be high. Projections of future growth should be based on a methodology that can be updated on a quarterly basis and that uses contemporaneous market signals (such as current or forward prices of the industry's product, new orders, current industry sales or employment) to project future employment. The methodology must be capable of giving timely warning of industry turn arounds like the one that occurred in 1981 in oil drilling and explanation. A projection of rapid growth would be sufficient on its own (in

the absense of high past rates of growth) only if the evidence is particularly strong (e.g. Congressional passage of obligational authority for a huge multi year contract. Where classroom training at schools or colleges substitutes for OJT, information on the number of graduation of such programs (recent and projected) would have to be compared to growth of demand.

26. The survey would not be very costly and would not take long, once a sample of employers who have trained such workers was obtained. While visits to establishments by specialized staff would be the preferred mechanism, it could be done over the phone. A telephone interview approach to measuring on-the-job training costs for specific jobs has been developed by the National Center for Research in Vocational Education and implemented by the Gallup Organization at a cost of less than $75 per interview. The training costs that would be measured by this survey would include:

1) payments to outside vendors such as a training institution,
2) depreciation on machinery 100 percent devoted to training,
3) time of specialized training personnel that is spent in contact with the trainee or preparing lessons,
4) time of supervisors or coworkers spent giving formal or informal training to the non-worker above a 40 hour minimum,
5) time of the trainee that is spent in a formal or informal training activity that is not directly productive.

The survey would also serve as a basis for developing an operational definition of the job or skill for which training subsidies would be provided, and for the levels of the skills. The results of the survey would be reviewed by DOL staff and the industry/labor committee. DOL staff would make a formal recommendation to the Secretary which the advisory committee could endorse or take exception to as it wished. Training costs allowed in future years would be indexed to the economy's average hourly wage, so the survey would only need to be done once.

27. Systems for competency certification currently exists in construction, telecommunications, banking and a varitey of other industries. In some industries and occupations, an existing system(s) could be adopted "as is" or modified; in other industries and occupations a new system would have to be developed. Since an occupation is eligible for a critical skills training subsidy for only a limited period, a judgement would have to be made as to whether the benefits of competency certification would outweigh the inevitable costs and delays that such a requirement would impose. In addition, in certain fast changing fields codifying what must be learned in this way might not be desirable. There would be an expectation that the organization sponsoring the competency certification after the end of the period of the occupation's eligibility. Conditioning the CSTI on the existence of competency certification would tend to encourage industry groups seeking designation of one of their job/skills as a critical skill to create a certification process for that job.

28. The application form could be quite simple, requiring only the name and social secruity number of the trainee, employer ID number, the training establishment's name and address, the firm's name and address, the skill for which training is being provided, the trainee's wage, and a description of the job (including its wage) for which he/she is being trained.

29. An advance opinion as to the eligibility of a proposed training program (binding on DOL) would be available to employers who request it. The calculated amount of subsidy would be paid in equal semiannual installments over the training period that has been established for that skill. If the worker is employed at the firm for less than the full training period, the subsidy payment would be prorationed for the period he/she was at the firm. The payments would be taxable income. Training establishments would submit semi-annual bills to DOL for the subsidy payments due to it. The payment would be made to the training establishment (even when that establishment is part of a multi-establishment firm) because auditing would be carried out at the establishment level, and because the payment then shows up in the right place in multi-establishment firms with divisional profit centers.

APPENDICES

Appendix A

Computational Notes

The firm's expected profit maximization problem is written as--

(A.1) $$\underset{g,\ h,\ w^1,\ w^2}{\text{Max}}\ P-C(g,h)-w^1+D_a\{\Pr(S)\Pr(K)(P+g+h+E(\varepsilon_o|K)-w^2)\}$$

subject to

(A.2) $$R \leq w^1+D_b\{\Pr(S)\Pr(K)w^2+(1-\Pr(K))w^3+(1-\Pr(S))\Pr(K)(w^3+E(\varepsilon|Q))\}$$

Denoting the Lagrangean function and the multiplier by L and λ, the first order conditions for g, h, w^1, w^2 are as follows:

(A.3) $$-Cg + D_a\{\frac{\partial(\Pr(S)\Pr(K))}{\partial g}(P+g+h+E(\varepsilon_o|K)-w^2)+\Pr(S)\Pr(K)(1+\frac{\partial E(\varepsilon_o|K)}{\partial g})$$

$$+ \lambda D_b\ \frac{\partial(\Pr(S)\Pr(K))}{\partial g}w^2+(1-\Pr(K))w_g^3 - \frac{\partial \Pr(K)}{\partial g}w^3$$

$$+ (\frac{\partial \Pr(K)}{\partial g} - \frac{\partial(\Pr(S)\Pr(K))}{\partial g})(w^3+E(\varepsilon|Q))$$

$$+ (1-\Pr(S)\Pr(K))\ \{w_g^3 + \frac{\partial E(\varepsilon|Q)}{\partial g}\}] = 0$$

(A.4) $$-C_h + D_a\{\frac{\partial(\Pr(S)\Pr(K))}{\partial h}(P+g+h+E(\varepsilon_o|K)-w^2)+\Pr(S)\Pr(K)(\frac{\partial E(\varepsilon_o|K)}{\partial h} + 1)\}$$

$$+ \lambda D_b\{\frac{\partial(\Pr(S)\Pr(K))}{\partial h}w^2 - \frac{\partial \Pr(K)}{\partial h}w^3 + (1-\Pr(S))\frac{\partial \Pr(K)}{\partial h}(w^3+E(\varepsilon|Q))\}$$

$$= 0$$

(A.5) $$-1 + \lambda = 0$$

(A.6) $$D_a\{\frac{\partial(\Pr(S)\Pr(K))}{\partial w^2}(P+g+h+E(\varepsilon_o|K)-w^2)+\Pr(S)\Pr(K)(\frac{\partial E(\varepsilon_o|K)}{\partial w^2} - 1)\}$$

$$+ \lambda D_b\{\frac{\partial(\Pr(S)\Pr(K))}{\partial w^2}(w^2 + \Pr(S)\Pr(K) - \frac{\partial \Pr(K)}{\partial w^2}w^3$$

$$- \frac{\partial(\Pr(S)\Pr(K))}{\partial w^2}(w^3+E(\varepsilon|Q)) + (1-\Pr(S)\Pr(K))\ \frac{\partial E(\varepsilon|Q)}{\partial w^2}\} = 0$$

The conditional expectations of the random factors are given by--

$$E(\varepsilon_o|K) = \int_{w^2-P-g-h}^{\infty} \tau\phi_o(\tau)d\tau \; / \; Pr(K)$$

$$E(\varepsilon|Q) = \int_{-\infty}^{w^2-w^3(g)} \tau\phi(\tau)d\tau \; / \; Pr(Q).$$

Then the partial derivatives with respect to g, h, w^2 are*>

$$\frac{\partial Pr(S)}{\partial g} = -\,\phi w_g^3, \qquad \frac{\partial Pr(S)}{\partial h} = 0, \qquad \frac{\partial Pr(S)}{\partial w^2} = \phi,$$

$$\frac{\partial Pr(K)}{\partial g} = \phi_o$$

$$\frac{\partial Pr(K)}{\partial h} = \phi_o$$

$$\frac{\partial Pr(K)}{\partial w^2} = -\phi_o$$

$$\frac{\partial E(\varepsilon_o|K)}{\partial g} = -\phi_o \cdot D_K/Pr(K)$$

$$\frac{\partial E(\varepsilon_o|K)}{\partial h} = -\phi_o \cdot D_K/Pr(K)$$

$$\frac{\partial E(\varepsilon_o|K)}{\partial w^2} = \phi_o D_K/Pr(K)$$

where $D_K = P+g+h+E(\varepsilon_o|K)-w^2$

$$\frac{\partial E(\varepsilon|Q)}{\partial g} = \phi w_g^3 \; D_Q/Pr(Q)$$

$$\frac{\partial E(\varepsilon|Q)}{\partial h} = 0$$

$$\frac{\partial E(\varepsilon|Q)}{\partial w^2} = -\phi D_Q/Pr(Q)$$

where $D_Q = w^2-w^3-E(\varepsilon|Q)$.

---

*> ϕ_o is evaluated at $w^2-P-g-h$,

ϕ is evaluated at w^2-w^3.

The next expressions are important to what follows:

$$\alpha_g \equiv \frac{\partial(\Pr(S)\Pr(K))}{\partial g} = \phi \cdot w_g^3 \Pr(K) + \phi_o \cdot \Pr(S),$$

$$\alpha_w \equiv \frac{\partial(\Pr(S)\Pr(K))}{\partial w^2} = \phi \cdot \Pr(K) - \phi_o \cdot \Pr(S),$$

$$\alpha_h = \frac{\partial(\Pr(S)\Pr(K))}{\partial h} = \phi_o \Pr(S).$$

Substitution of the partial derivatives into (A.3), (A.4), and (A.6) yields the f.o.c.'s for g, h, and w^2.

From the f.o.c. for g, (A.3)

$$\begin{aligned} C_g = {} & D_a[\alpha_g D_K + \Pr(S)\Pr(K)(1 - \phi_o D_K/\Pr(K))] \\ & + D_b[(\alpha_g w^2 + (1-\Pr(K))w_g^3 - \phi_o w^3 + (\phi_o - \alpha_g)(w^3+E(\varepsilon|Q)) \\ & + (1-\Pr(S)\Pr(K))\{w_g^3 - \phi w_g^3 D_Q/(1-\Pr(S))\}]. \end{aligned}$$

After rearranging terms, we obtain the equation (6).

$$\begin{aligned} (6) \quad C_g = {} & D_a[\Pr(S)\Pr(K) - \phi w_g^3 \Pr(K) D_K] \\ & + D_b[(1-\Pr(S)\Pr(K))w_g^3 + \phi_o G_K] \end{aligned}$$

where $G_K = \Pr(S) D_Q + E(\varepsilon|Q))$.

From (A.4)

$$\begin{aligned} C_h = {} & D_a[\alpha_h \cdot D_K - \Pr(S)\phi_o \cdot D_K + \Pr(S)\Pr(K)] \\ & + D_b[\alpha_h \cdot w^2 - \phi_o w^3 + (1-\Pr(S))\ \phi_o \cdot (w^3+E(\varepsilon|Q)). \end{aligned}$$

This yields the f.o.c. for h, (7).

$$(7) \quad C_h = D_a \Pr(S)\Pr(K) + D_b \phi_o G_K.$$

From (A.6)

$$\begin{aligned} 0 = {} & D_a[\alpha_w D_K + \Pr(S)\Pr(K)(D_K \phi_o/\Pr(K) - 1)] \\ & + D_b[\alpha_w w^2 + \Pr(S)\Pr(K) + \phi_o w^3 - \alpha_w(w^3+E(\varepsilon|Q)) \\ & - (1-\Pr(S)\Pr(K))(\phi D_Q/\Pr(Q))]. \end{aligned}$$

After rearranging terms, we get (5):

$$(5)\quad 0 = D_a[-\phi \cdot \Pr(K)\, D_K + \Pr(S)\Pr(K)] + D_b[\Pr(S)\Pr(K) - \phi_o\, G_K].$$

From (5),

$$D_K = P+g+h+E(\varepsilon_o|K) - w^2 = \frac{D_a - D_b}{D_a}\,\frac{\Pr(S)}{\phi} + \frac{D_b}{D_a}\,\frac{\Pr(S)}{\Pr(K)}\,(D_Q + \frac{E(\varepsilon|Q)}{\Pr(S)}).$$

Substituting the explicit form of D_Q and denoting

$$\frac{D_a}{D_b}\,\frac{\phi_o}{\phi}\,\frac{\Pr(S)}{\Pr(K)} \text{ by } \Theta,$$

we transform the above equation to the following form:

$$-(1+\Theta)w^2 = -(P+g+h+E(\varepsilon_o|K)) - \Theta(w^3 + E(\varepsilon|Q) - \frac{E(\varepsilon|Q)}{\Pr(S)})$$

$$+ \frac{(D_a - D_b)}{D_a}\,\frac{\Pr(S)}{\phi}$$

$$w^2 = \frac{1}{1+\Theta}(P+g+h+E(\varepsilon_o|K) + \frac{\Theta}{1+\Theta}(w^3 + E(\varepsilon|Q) - \frac{E(\varepsilon|Q)}{\Pr(S)})$$

$$+ \frac{(D_a - D_b)}{D_a}\,\frac{\Pr(S)}{\phi(1+\Theta)}$$

$$= P+g+h+E(\varepsilon_o|K) + \frac{\Theta}{1+\Theta}\,\{w^3 - (P+g+h+E(\varepsilon_o|K)$$

$$+ \frac{(\Pr(S)-1)}{\Pr(S)}\,E(\varepsilon|Q)\} - \frac{(D_a - D_b)}{D_a}\,\frac{\Pr(S)}{\phi(1+\Theta)}\,.$$

Substitution of $w^3 = P - T + \hat{g}$ gives

$$w^2 = P+g+h+E(\varepsilon_o|K) - \frac{\Theta}{1+\Theta}\,[T+h+g-\hat{g}+E(\varepsilon_o|K) + \frac{1-\Pr(S)}{\Pr(S)}\,E(\varepsilon|Q)$$

$$- \frac{D_a - D_b}{D_a}\,\frac{\Pr(S)}{\phi(1+\Theta)}\,.$$

Using the relation, $E(\varepsilon) = \Pr(S)E(\varepsilon|S) + \Pr(Q)E(\varepsilon|Q) = 0$, we can write $E(\varepsilon|S)$ as--

$$E(\varepsilon|S) = -\frac{(1-\Pr(S))E(\varepsilon|Q)}{\Pr(S)}\,.$$

Then, w^2 is given by (10).

$$(10)\quad w^2 = P+g+h+E(\varepsilon_o|K) - \frac{\Theta}{1+\Theta}\,[T+g+h-\hat{g}+E(\varepsilon_o|K) - E(\varepsilon|S)]$$

$$- \frac{D_a-D_b}{D_a}\,\frac{Pr(S)}{\phi(1+\Theta)}$$

$$\Theta = \frac{D_b}{D_a}\,\frac{\phi_o}{\phi}\,\frac{Pr(S)}{Pr(K)} > 0.$$

Appendix B

Magnitudes of Second Order Effects

It will be interesting to compare our first order conditions for g and h with those in models where the probabilities of dismissal and quitting are fixed. When the probabilities of dismissal and quitting are exogeneously determined, the first order conditions for general skill and specific skill are written as follows:

for general skill,

(1) $C_g = D_a \cdot Pr(S)\ Pr(K) + D_b(1-Pr(S)\ Pr(K))w_g^3$,

and for specific skill,

(2) $C_h = D_a\ Pr(S)\ Pr(K)$.

The differences in the right-hand sides in the above first order conditions and those in our endogeneous quit/dismiss model are:

(3) $-D_a \cdot \phi Pr(K)\ D_k w_g^3 + D_b\ \phi_o\ G_k$,

(4) $D_b\ \phi_o$.

We shall call the terms in (3) and (4) the second order effects.

These differences depend on w_g^3, the responsiveness of wage growth in other employment to general training; D_k, the expected profit from the worker the firm wants to keep; G_k, the benefit to the worker of not being dismissed by the firm; and ϕ, ϕ_o, the responsiveness of quit/dismissals to the wage rate. (3) is rewritten as (5).

(5) $-D_a\ w_g^3 \eta\ Pr(S)\ Pr(K)\frac{D_k}{w^2} + D_b \eta_o Pr(K)\frac{G_k}{w^2}$

$$\text{where } \eta = \frac{Pr(S)}{w^2}\ \frac{w_2}{Pr(S)} = \phi\ \frac{w_2}{Pr(S)}$$

$$\eta_o = -\ \frac{Pr(K)}{w^2}\ \frac{w_2}{Pr(K)} = \phi_o\ \frac{w_2}{Pr(K)}$$

η is the elasticity of the probability of staying with respect to the second period wage,

η_o is the elasticity of the probability of wanting to keep worker with respect to the second period wage,

and

G_k is the workers benefit from not being dismissed.

Using the above notation (4) is rewritten as

(6) $D_b \eta_o \Pr(K) \frac{G_k}{w^2}$,

We can get a "feel"for the magnitudes of (5) and (6) from Bishop's (1982) estimates of quit and dismiss probabilities. According to his results, rough estimates of η_o and η are less than 0.1.

We set hypothetical values of η_o, η, Pr(K), Pr(S), D_a, D_b, D_k/w^2, G_k/w^2, and w_g^3 as follows:

$\eta_o = 0.1 \quad \eta = 0.1$
$\Pr(S) = 0.75$
$\Pr(K) = 0.9$
$D_k/w^2 = 0.1$
$G_k/w^2 = 0.20$
$w_g^3 = 0.4$
$D_a = 0.9$
$D_b = 0.8$

Substituting these values into the first order condition for general capital when quit and dismiss rates are exogeneous is--

$0.9(0.75)(0.9) + 0.8(1-0.9\cdot 0.75)0.4 = 0.712$

and the second order effect is

$-0.9(0.1)(0.75)(0.9)(0.1)(0.4) + 0.8(0.1)(0.9)\cdot(0.15) = 0.008.$

Also, the numerical values of the marginal condition for specific capital when Pr(S) and Pr(K) are fixed is

$0.9(0.75)(0.9) = 0.607,$

and the second order effect is

$0.8(0.1)(0.9)0.1 = 0.0072.$

These numbers suggest that the firm's investment decisions on general and specific capitals should be quite close to the case where the firm behaves and if the probabilities of dismiss and quits are independent of wage rates.

Appendix C

1982 National Survey of Employers Questionnaire

(Part A)

			66-71/72-77
270. When did you learn (NAME) was eligible?	___ ___- 19___ ___ MO YR DK............999998 NA............999999	___ ___- 19 ___ ___ MO YR DK.............. 999998 NA.............. 999999	78 = bl 79 = 1 80 = 1 C. 12 1-bl NEW ID: 2-5
271. From which program is the money coming?	TJTC..................1 WIN Tax Credit..2 CETA-OJT.........3 WIN-OJT............4 Other Government Subsidy SPECIFY_______5 DK....8 NA....9	TJTC.................. 1 WIN Tax Credit.. 2 CETA-OJT........ 3 WIN-OJT............ 4 Other Government Subsidy SPECIFY________5 DK..................... 8 NA..................... 9	6/7

271A. The questions in this section ask about worker training and supervision for NAME'S position.

Once we get started if you find it is necessary for me to talk to a supervisor for that position please transfer me to him/her at the end of this interview.

271B. IF YOU MUST SPEAK TO A SUPERVISOR ASK SECTIONS "C" AND "D". ASK FOR SUPERVISOR AT END OF INTERVIEW. ASK 271C - 284.

271C. Is there formal training, such as self-paced learning programs or training done by specially trained personnel, for people hired in NAME's position, or is all the training done as informal on the job training?	Formal training . . .ASK 272 . . .1 All informal . . . GO TO 273 . . .2 DK . . . . . .ASK 272. . . . .8 NA . . . . . .ASK 272. 9	8

272. For the following questions we ask comparisons among NAMES 1 and 2 and your typical new employee in the same position.

During the first 3 months of work what was the total number of hours spent on formal training such as self-paced learning programs or training done by specially trained personnel, of . . .

A. Your typical worker in (NAME'S) position.

___ ___ ___ *9-11*

RECORD HOUR

Some, DK#................996
None..........................997
DK.......................... 998
NA.......................... 999

B. NAME 1 (RECORD VERBATIM IF NOT IN HOURS; DO CONVERSION IF CLEAR)

___ ___ ___ *12-14*

RECORD HOUR

Some, DK#................996
None..........................997
DK.......................... 998
NA.......................... 999

C. NAME 2 (RECORD VERBATIM IF NOT IN HOURS; DO CONVERSION IF CLEAR)

___ ___ ___ *15-17*

RECORD HOUR

Some, DK#................996
None..........................997
DK.......................... 998
NA.......................... 999

INTERVIEWER NOTE: IF RESPONDENT ANSWERS QUESTION 272A, B or C IN TERMS OF DAYS, WEEKS OR MONTHS READ: You mean NAME received training 8 hours a day for _____days/weeks/months?

273. IF NOT ALREADY READ, READ:

In the following questions I am going to ask for comparisons among NAMES 1 and 2 and your typical new employee in the same position.

Now switching to informal training during their first 3 months of work, what was the total number of hours management and line supervisors spent away from other activities giving informal individualized training or extra supervision to:

A. Your typical worker in (NAME'S) position.

___ ___ ___ *18-20*

RECORD HOUR
Some, DK#................996
None...........................997
DK.......................... 998
NA.......................... 999

B. NAME 1 (IF NOT THERE FOR 3 MONTHS ASK: For the period he/she was there how many hours of informal training did he/she receive?)

___ ___ ___ *21-23*

RECORD HOUR
Some, DK#................ 996
None.......................... 997
DK..........................998
NA..........................999

C. NAME 2 (IF NOT THERE FOR 3 MONTHS ASK: For the period he/she was there, how many hours of informal training did he/she receive?)

___ ___ ___ *24-26*

RECORD HOUR
Some, DK#................ 996
None.......................... 997
DK..........................998
NA..........................999

INTERVIEWER NOTE: IF RESPONDENT ANSWERS QUESTION 273A, B, or C IN TERMS OF DAYS, WEEKS OR MONTHS READ: You mean NAME received training 8 hours a day for ____ days/weeks/months?

IF 273A, B AND C ARE DK ASK 274. OTHERWISE GO TO 277.

274. How many different management and supervisory level persons give your typical employee in (NAME'S) position informal training?

__ __
RECORD NUMBER
Some, DK#................ 96
DK......................... 93
NA......................... 99

27-28

275. About how many total days of informal training does the typical management level person spend informally training your typical new employee in (NAME'S) position?

__ __
RECORD DAYS
Some, DK#................ 96
DK......................... 98
NA......................... 99

29-30

276. How many hours each day does the typical management person spend away from performing other duties in order to informally train a typical new employee?

__ __
RECORD HOURS
Some, DK#................ 96
None....................... 97
DK......................... 98
NA......................... 99

31-32

277. During the first 3 months of work what was the total number of hours co-workers who are not supervisors spent away from their normal work giving informal individualized training or extra supervision to:

A. Your typical worker in (NAME'S) position.

___ ___ ___ 33-35

RECORD HOUR

Some, DK#............ 996
None....................... 997
DK........................ 998*
NA........................ 999

B. NAME 1 (IF NOT THERE FOR 3 MONTHS ASK: For the period he/she was there how many hours of informal training did he/she receive?)

___ ___ ___ 36-38

RECORD HOURS

Some, DK#...............996
None.........................997
DK........................ 998*
NA........................ 999

C. NAME 2 (IF NOT THERE FOR 3 MONTHS ASK: For the period he/she was there how many hours of informal training did he/she receive?)

___ ___ ___ 39-41

RECORD HOUR

Some, DK#...............996
None.........................997
DK........................ 998*
NA........................ 999

INTERVIEWER NOTE: IF RESPONDENT ANSWERS QUESTION 277A, B or C IN TERMS OF DAYS, WEEKS OR MONTHS READ: You mean NAME received training 8 hours a day for ___days/weeks/months?

(*)
IF 277A, B AND C ARE ALL DK ASK 278. OTHERWISE GO TO 281.

278. How many different co-workers give your typical employee in (NAME'S) position informal training?	___ ___ RECORD NUMBER Some, DK#.................. 96 None.......................... 97 DK.......................... 98 NA.......................... 99	42-43
279. About how many total days of informal training does the average co-worker spend on training your typical new employees in (NAME'S) position?	___ ___ RECORD DAYS Some, DK#.................. 96 None.......................... 97 DK.......................... 98 NA.......................... 99	44-45
280. How many hours each day does the average co-worker spend away from performing other duties in order to informally train a typical new employee?	___ ___ RECORD HOURS Some, DK#.................. 96 None.......................... 97 DK.......................... 98 NA.......................... 99	46-47

281. The last set of questions in this section asks about employee productivity.

Please rate your employee on a productivity scale of zero to 100, where 100 equals the maximum productivity rating any of your employees (NAME'S) position can attain and zero is absolutely no productivity by your employee. 48-50bl

282. What productivity score would you give your typical worker who has been in this job for 2 years? (PROBE FOR NUMBER)	___ . ___ ___ * RECORD NUMBER DK........................ 998 NA........................ 999	51-53

283. Now, for each of the following time periods compare the productivity on this same scale of (NAME 1), (NAME 2) and your typical worker in this position. What is the productivity of (NAME/your typical worker) during (READ LIST) . . .

	NAME 1	NAME 2	TYPICAL WORKER	
A. (His/her) first 2 weeks of employment?	___ ___ ___ RECORD # NONE..997 DK..998 NA..999	___ ___ ___ RECORD # NONE..997 DK..998 NA..999	___ ___ ___ RECORD # NONE..997 DK..998 NA..999	54-56/57-59/60-62
B. From (his/her) 3rd week to the 12 week at work? (IF NAME 1/ NAME 2 LEFT COMPANY BEFORE 12th WEEK - Q. 257 - DO NOT ASK Q. 283C)	___ ___ ___** RECORD # DK..998 NA..999	___ ___ ___ RECORD # DK..998 NA..999	___ ___ ___* RECORD # DK..998 NA..999	63-65/66-68/69-71
C. (DO NOT ASK FOR TYPICAL WORKER) Today? OR, IF NAME NO LONGER WORKS FOR COMPANY READ: The last week NAME worked for your company?	___ ___ ___** RECORD # DK..998 NA..999	___ ___ ___ RECORD # DK..998 NA..999		72-74/75-77 78 31 79-80 =12

283A.IF TYPICAL WORKER - IS LESS PRODUCTIVE AFTER 2 YEARS (Q.282 IS LESS THAN Q. 283B, TYPICAL WORKER*) ASK 284. OTHERWISE GO TO 284A.

C.13
1 = 31.
New ID: 2-5

205. In the first three months of employment, approximately how many total hours does a typical new employee in NAME'S position spend away from normal work activities filling out forms and being told about the company history, benefits and rules?

____ ____

RECORD HOURS
NONE.............. 97
DK.............. 98
NA.............. 99

48-49

206. During the first three months, how many total hours does the average new employee spend in training activities in which he or she is watching other people do the job rather than doing it himself?

___ ___ ___

RECORD HOURS
NONE............ 997
DK............ 998
NA............ 999

50-52

207. How many weeks does it take a new employee hired for this position to become fully trained and qualified if he or she has no previous experience in this job, but has had the necessary school-provided training?

____ ____ ____

RECORD WEEKS
NONE............ 997
DK............ 998
NA............ 999

53-55

208. How many of the skills learned by new employees in this job are useful outside of this company? (READ LIST)...

Almost all.................... 1
Most.............................. 2
Some............................. 3
Or almost none............ 4
DK.............................. 8
NA.............................. 9

56

209. Focusing on the skills that are useful outside your company, how many other companies in the local labor market have jobs that require these skills? Would you guess (READ LIST)...

less than 5...................... 1
5 to 15.............................. 2
16 to 100.......................... 3
or over 100...................... 4
DK.................................. 8
NA.................................. 9

57

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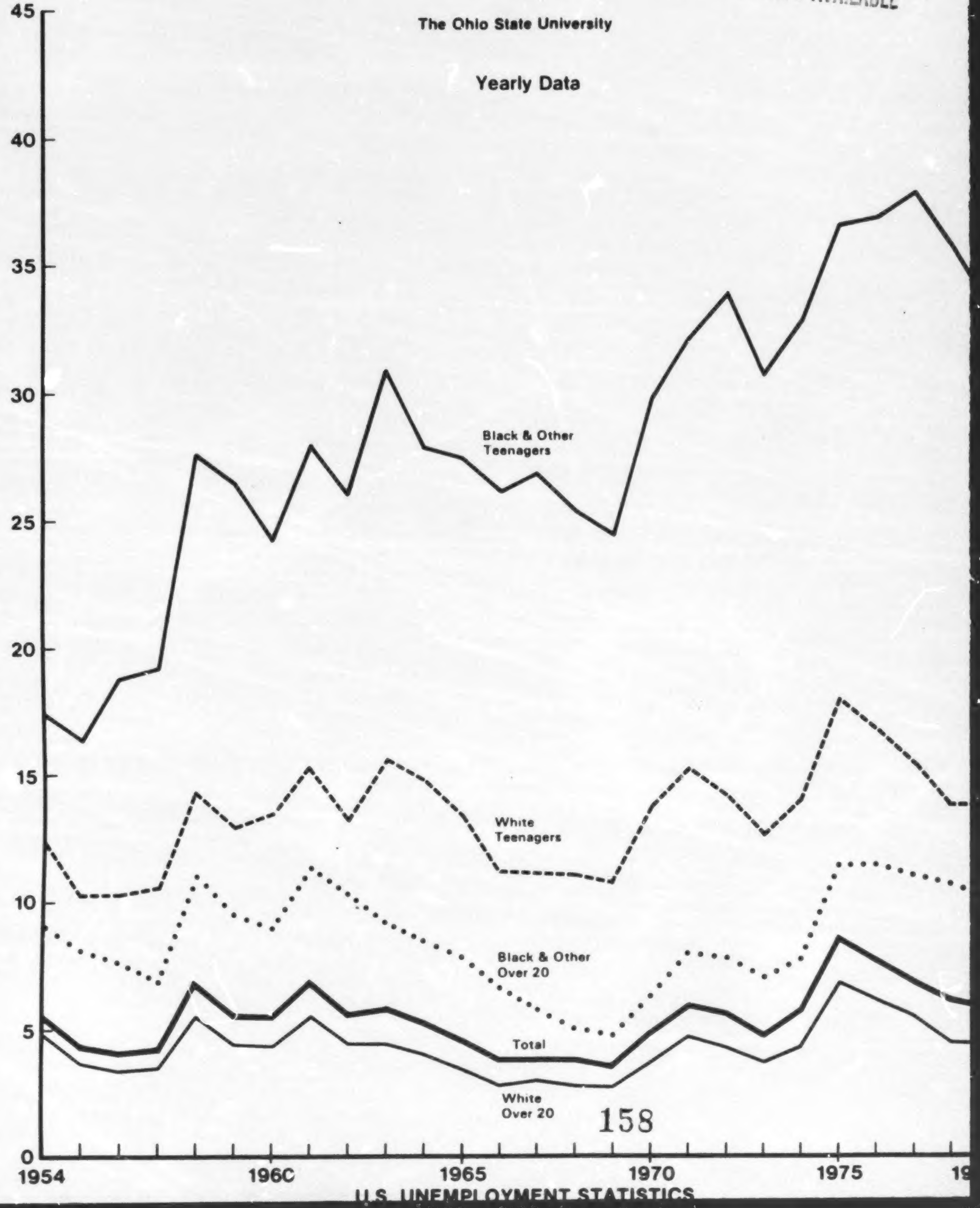

Yearly Data

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